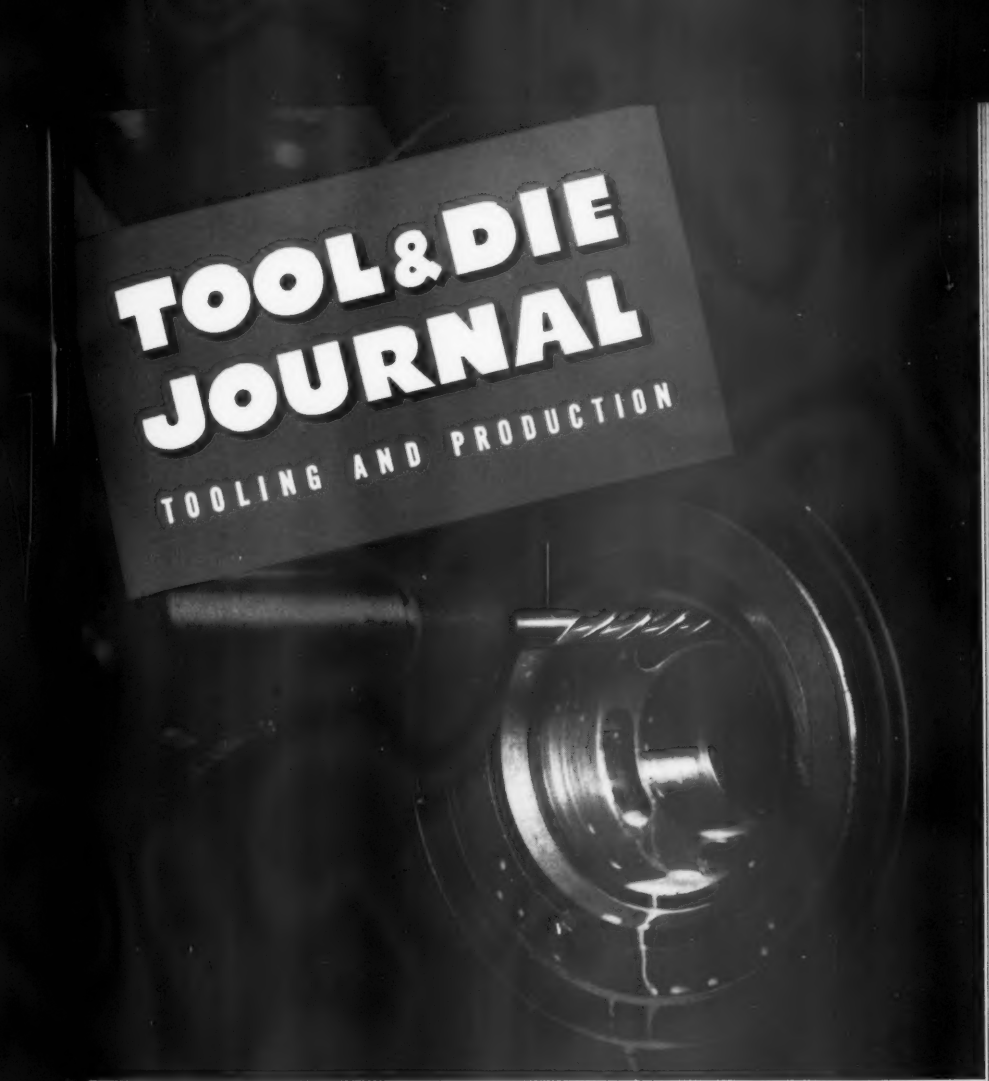
TOOL & DIE JOURNAL
TOOLING AND PRODUCTION



CONTOUR MILLING AT GREAT DEPTH

... Just the job for Putnam Hi-Speed End Mills

This is another of those tough armament jobs on which Putnam Hi-Speed End Mills excel. The steel is hard . . . the cut is intricate . . . good finish is required.

Illustrated is a standard Putnam Hi-Speed Extra Long End Mill milling four radial slots in the breech housing on an anti-aircraft gun. The slots themselves are deep and in addition are recessed in the face of the piece. This means great strain on the mill. Putnam Mills have been doing the job with a minimum of breakage . . . and, therefore, a minimum of production time lost.

"For High Achievement"

ARMY (E) NAVY

PUTNAM TOOL COMPANY

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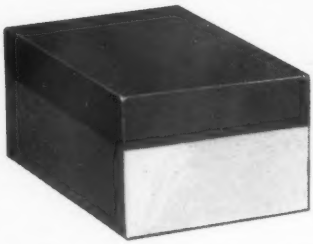
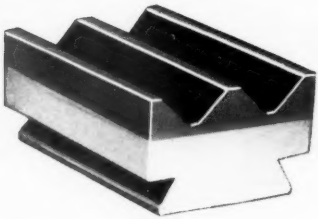
NEW WAY TO CONSERVE HIGH SPEED STEEL





Dovetail forming cutters made from FCC Electrically Welded Composite Steel Blanks ***(high speed steel cutting face; mild steel base)*** **save at least 50% of high speed steel. Besides, they offer other distinct advantages. Obvious among them are:—**

1. **Non-hardenable, tough base minimizes tendency to crack and break out at sharp dovetail corners and screw holes during heat treating or when working.**

2. **Easier to drill and tap screw holes and machine dovetails in mild steel base; this work may be done** ***after*** **hardening if desired.**

3. **More prompt delivery because of reduced amount of high speed steel.**

4. **Inseparable bond between cutting face and base assured by special technique of electric welding.**

5. ***Marked saving of strategically important tungsten.***

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QUALITY FCC SERVICE

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BE MODERN...equip your machines with SJOGREN SPEED COLLET CHUCKS

Are you getting full value from your investment in tool-room and engine lathes?

A Sjogren Speed Collet Chuck gives greater capacity, saves time, increases accuracy and assures better results.

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Available in three sizes: 1", 1-3/8" and 1-3/4" capacity.

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THE TOOL & DIE JOURNAL

GEORGE J. HUEBNER • EDITOR, PUBLISHER

Assistant Editors

DON E. ROOT

CHARLES H. HAYNES

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MARY D. VECCIA

◆

Published monthly for key men responsible for designing, building and using Precision Tooling. The TOOL & DIE Journal is the official publication of The Tool & Die Institute. Controlled circulation covering certified operating executives, department heads and key men—CBI Coverage; others including Schools, Libraries and Students $1.50; Foreign $2.00; Single current copies 15c; Other available issues 20c. Advertising, Editorial and Circulation offices at 2460 Fairmount Boulevard, Cleveland, Ohio. Telephone FAirmount 4040.

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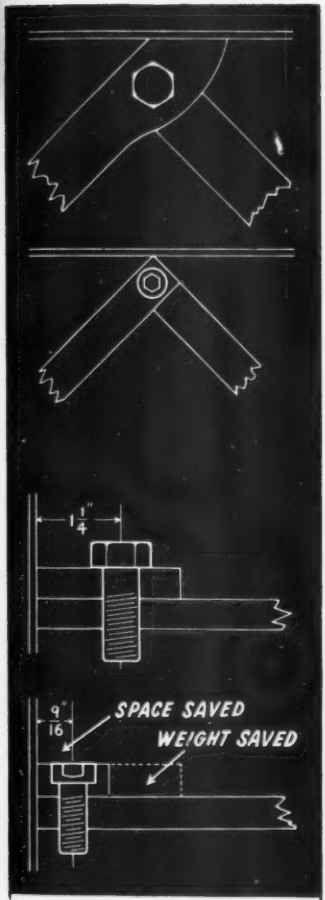

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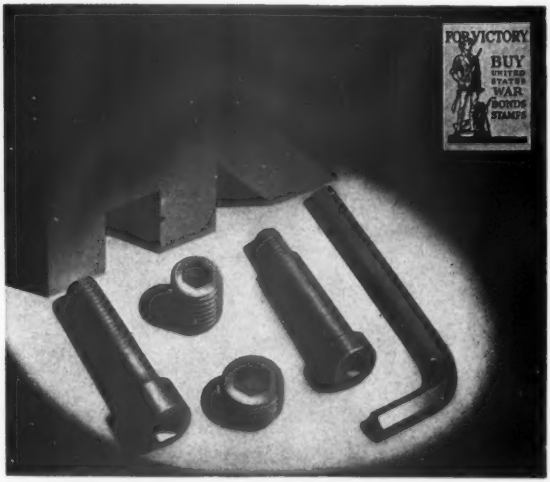

WRITE FOR YOUR COPY OF COMPLETE SOCKET SCREW STANDARDS

THE HOLO-KROME SCREW CORP. HARTFORD, CONN., U. S. A.

.....One day the Dove

BEYOND the horizon of this war-torn world—the dove of peace is waiting ... No man knows how far or how near.

But as sure as the sun rises—that dove will alight again and peace be restored.

Meanwhile—you and we have a job to do. Your job as civilian is to buy War Bonds and War Savings Stamps to the best of your ability. Our job as a manufacturer is to buy bonds, too. But our *most important job right now* is to help keep our fighting forces supplied with the ammunition they *must* have to clear the way for peace.

Making tools that make the bullets is our sole endeavor today. All former peacetime production has been relegated to this single purpose. We are at it night and day.

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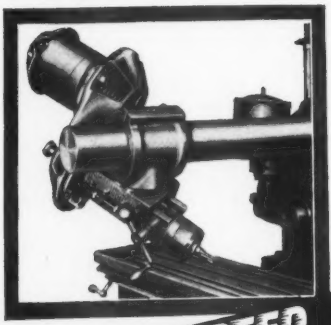
New HALCO UNIVERSAL HEAD

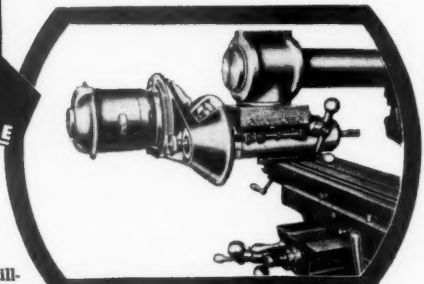
Only Machine Made On This Lathe Principle

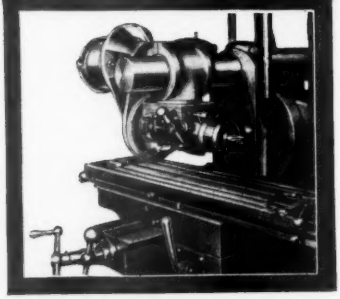
for High Speed MILLING, DRILLING, BORING and COUNTER BORING

Five Speeds 350 to 2900 R.P.M. Also 10 speeds 125 to 2900 R.P.M. available at extra cost.



FOR HIGH SPEED MILLING, DRILLING, BORING AND COUNTER BORING IN ANY ANGLE





THE Halco Hi-Speed Universal Milling Attachment has proven its importance in building tools, dies, jigs, fixtures, wood and metal patterns and other machine products. Its 4-inch vertical travel permits many milling, boring and facing operations in one setup, a factor of convenience to which is added the advantage that the unit can be easily mounted by one man, it weighing only 90 pounds. Each head is unconditionally guaranteed for six months.

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(Designers and Builders of Fine Machine Tools)

SEND TODAY FOR FOLDER

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MANUFACTURERS OF HALCO PRODUCTS

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"Empco JACK"

For ACCURATE and EASY Leveling of Machine Tools, Industrial Furnaces, Large Assembly Fixtures, Surface Plates, etc.

The illustrations tell much of the story. Designed to align themselves to the most uneven of floors; slip-ways are ground to minimize friction at point of contact with machine base. Positive two-way adjustment with increased limits. Simplest method of setting, and keeping equipment LEVEL. Turn the "hex" screw head and presto!—a level adjustment as precise as wanted.

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AVAILABLE IN 3 SIZES:

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THE ENTERPRISE MACHINE PARTS CORPORATION

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Son...

HE has just turned eighteen. Shaves twice a week and maybe a hair or two is sprouting on his chest. He shies away now when his dad tries to be affectionate and we noticed some lipstick on one of his handkerchiefs after a country club junior dance not so long ago. But it seems only yesterday, perhaps it was the day before, that he was a chubby legged kid swinging from the arch of the doorway, leading to the dining room, in a gadget that was something like a breeches buoy and he was sucking at the end of a turkey bone.

He went back to school this Fall, a tall, athletic lad, budding into manhood, but there was something else on his mind beside the football and hockey teams or the little blonde girl with whom he had "palled" around during the Summer. It seems as though he was listening for a certain call—the Clarion call that poets sing about—and, perhaps we just imagined it, but we thought we saw an upward jutting of his chin, a certain light in his eyes, and a sort of a rearing-to-go expression in his face.

It chilled us a bit in the region of our heart, when we thought of his discarding the sports coat for the "O.D." of the Army or the blue of the Navy. There was a bit of a catch in our throat as we thought of his putting aside his football helmet for one of steel; of his hanging up his hockey stick and reaching for a gun.

After all we still regard him as just a little boy.

They tell us that the eighteen and nineteen year old lads are to be called to the service. When that day comes to us there will be prayers, but no tears. We shall not mourn nor shall we be fearful. Rather there will come welling up from our hearts that warm feeling of pride that millions of other parents will sense when their beloved lads marched away. Our lad is no different than the others. We are no different than other loving parents, nor is our sacrifice any greater. They are going to make great soldiers, sailors, marines and fliers out of these youngsters. And they will become a mighty force when they take their places beside their brothers in arms. They too know what they fight for. They too know full well of the sacrifices that must be made before the evil powers that threaten the world can be overcome.

And let us not forget that they are counting on us. They know that we shall not fail them.

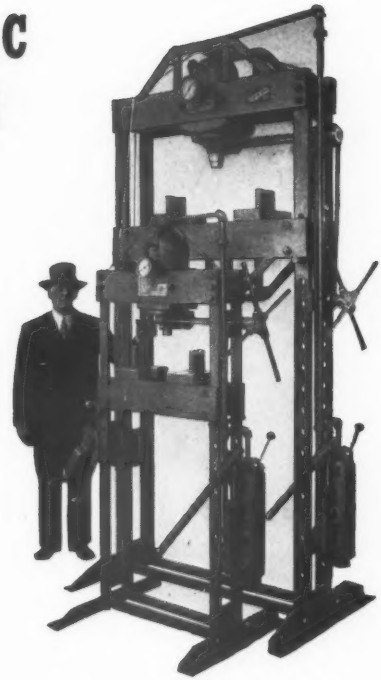
God be with them and their brothers.

THE CARBORUNDUM COMPANY, NIAGARA FALLS, N. Y.

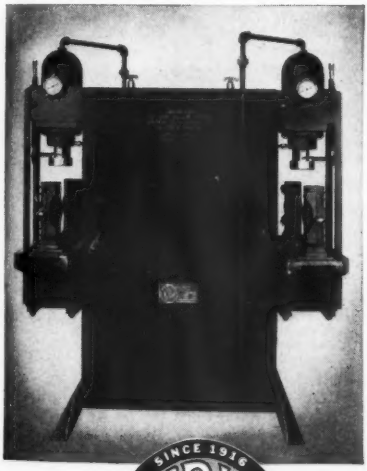
REG. U. S. PAT. OFF.

KRW HYDRAULIC ARBOR PRESSES

for War Production



Standard Hydraulic Presses in 25, 50 and 75 ton capacities. Special Presses engineered for specific war production needs.



The exclusive design features which have given KRW Standard Presses their reputation for speed and efficiency are available to war production manufacturers who require presses of special design. The illustration above shows a *special,* extra high 75 ton KRW Press in comparison with the Standard 25 ton unit. Opposite illustration shows a special, 4-man operated, air-oil Press used for bomb loading.

. . . KRW also builds bench-type Arbor Presses in 1/2, 1 and 3 ton capacities.

SINCE 1916 KRW A MARK OF DEPENDABILITY

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there IS a difference in taps

4 good reasons why

SOSSNER taps last longer and cut more perfect threads

CUTTING . . . Sossner taps are carefully fluted and mirror polished to precise depth and width for maximum strength, minimum friction, and best cutting angle.

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PRECISION GROUND FROM THE SOLID STOCK . . . All Sossner taps are ground to micro-finish from the hardened solid blank using the very latest equipment and our own newly developed methods.

ACCURACY . . . EVERY tap is measured with precision wires on master measuring instruments calibrated to .0001 in. Only the most modern and accurate equipment is used to check the form and lead.

TAPS AND GAGES OF AMERICAN NATIONAL AND BRITISH THREAD FORMS IN SPECIAL AND STANDARD SIZES

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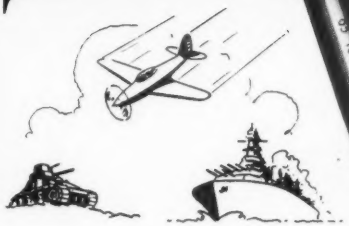
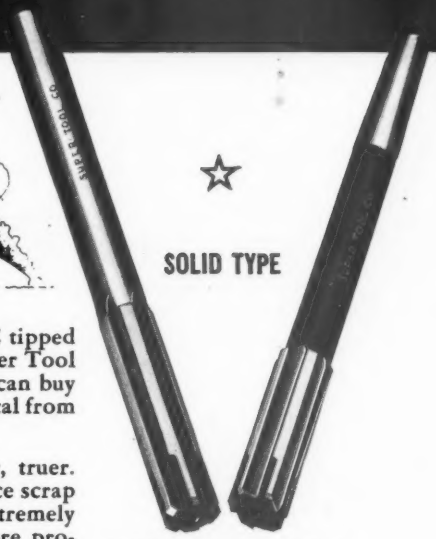
"32 year reputation for reliability and precision workmanship."

for LESS SCRAP in your plant and more *"Scrap"* on the fighting front!





Straight Shank Taper Shank

TUNGSTEN CARBIDE tipped standard reamers by Super Tool are the best that money can buy —and the most economical from every point of view.

They cut faster, cleaner, truer. They save time and reduce scrap —hold their size over extremely long runs—give you more production, and speed the stuff out to our fighting men.

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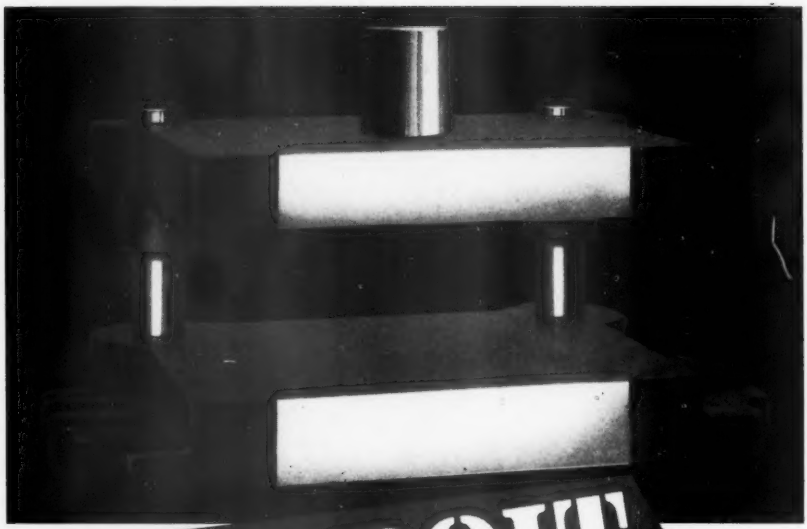

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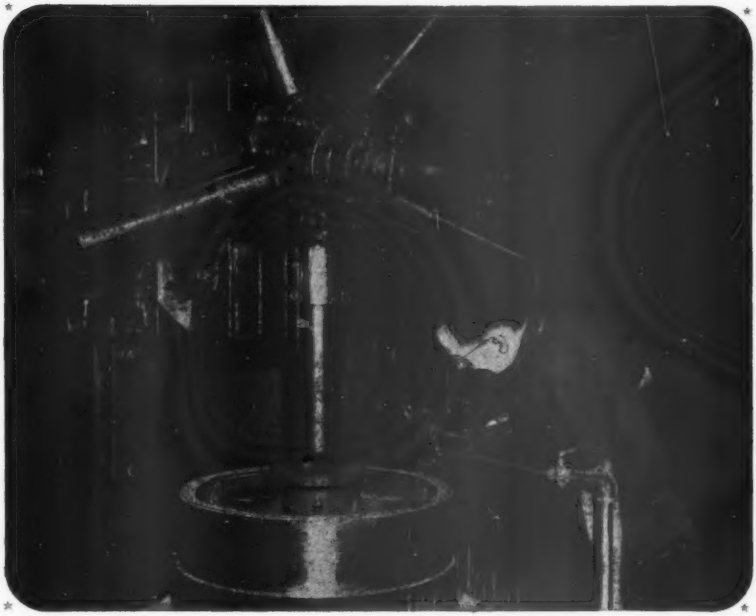


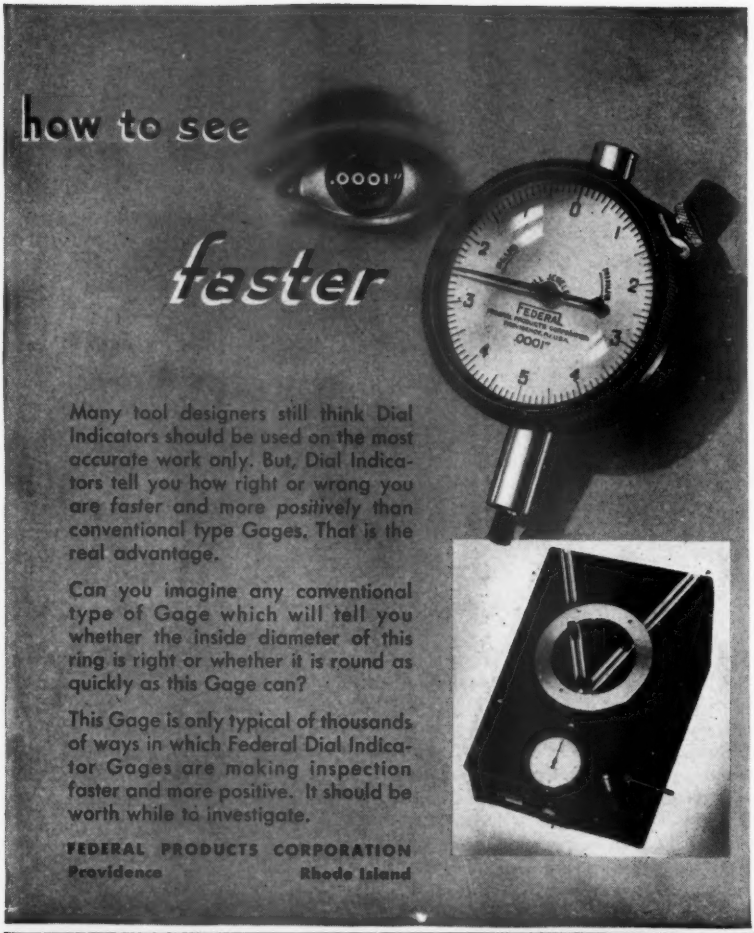
THERE'S MORE THAN ONE SHOT IN THE TOOL STEEL MAGAZINE

FOR every machining job, there is a tool steel which will produce optimum results as regards the amount of work done per machine hour and per grind.

Teaming up the right tool steel with the job frequently shows phenomenal improvement. For instance, with a connecting rod broach made of DBL High Speed Steel, a well-known engine builder secured 13,533 pieces for the life of the broach, against a previous best average of 8000 pieces. The increase is almost 70%. A similar company, using 3/8" twist drills made of DBL, secured an average of 30% more holes per grind than with 18-4-1.

War production calls for the best possible performance from every machine tool, new or old. Let our engineers help you to determine the right tool steels to use on your jobs, for improved results. At the same time, they'll make you familiar with the best *alternate* steel, for your protection in the event of possible future shortnesses in supply.

Allegheny Ludlum
STEEL CORPORATION
GENERAL OFFICES: PITTSBURGH, PENNSYLVANIA


how to see
.0001"
faster
FEDERAL
.001"
Many tool designers still think Dial Indicators should be used on the most accurate work only. But, Dial Indicators tell you how right or wrong you are *faster* and more *positively* than conventional type Gages. That is the real advantage.
Can you imagine any conventional type of Gage which will tell you whether the inside diameter of this ring is right or whether it is round as quickly as this Gage can?
This Gage is only typical of thousands of ways in which Federal Dial Indicator Gages are making inspection faster and more positive. It should be worth while to investigate.
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Thompson

SPRING TOOL HOLDER

No cutter breakage
No damaged work

THE WILLARD THREADING AND FORMING TOOL SPRING HOLDER.

The Willard Spring Tool Holder, a Thompson product, is versatile—adaptable to a wide variety of uses and gives consistent, efficient and economical results. For threading, the "Willard" produces smooth, accurate threads close to a shoulder—can be used for coarse or fine threads without danger of chatter or tool marks. When used as a forming tool it assures faster, smoother machining free from cutter marks—ratchet design prevents cutter from turning under heavy loads. The Cutting-Off Tool Holder makes possible faster feed with a heavier cut.

THREAD TOOL GRINDING FIXTURE

Above illustration shows a 60° thread cutter being finished ground. By reversing fixture, the cutter is accurately ground to correct angle in a few minutes—grinds square thread tool bits to a 60° or 29° angle with a 15° cutting rake — holds square cutters in sizes 5/16" to 3/8".

AUTO-ORDNANCE Corporation

THOMPSON TOOL DIVISION

342 WEST PUTNAM AVENUE GREENWICH, CONN.

70-137

WAR DEPARTMENT
ARMY AIR FORCES
MATERIEL CENTER
OFFICE OF THE DISTRICT SUPERVISOR
CENTRAL PROCUREMENT DISTRICT
8505 W. WARREN AVE.
DETROIT, MICH.

July 13, 1942

PRODUCTION SECTION
CENTRAL PROCUREMENT DISTRICT
MANUFACTURERS' LETTER NO. 10
CHICAGO AREA OFFICE

SUBJECT: Cemented Tungsten Carbide for Cutting Tools

1. The following is quoted from memorandum, dated June 19, 1942, from the War Department, Headquarters, Services of Supply, Washington, D.C.:

"In the interest of conservation of critical alloys and of increased production, attention is directed to the following stated advantages of cemented tungsten carbide tools . . .

"a. One pound of tungsten in the form of cemented tungsten carbide for cutting tools will do the work of 70 to 100 pounds of tungsten in high speed tool steel. Furthermore, its use eliminates substantial amounts of chromium and vanadium which are considered necessary components of practically all high speed tool steel.

"b. Cemented tungsten carbide functions satisfactorily on almost all types of lathes and boring machines, particularly those of the sturdier construction. This is said to include all such machine tools manufactured in the last five years.

"c. Cemented tungsten carbide works efficiently on all steels above approximately .30 carbon and is effective up to 500 brinell or more.

"d. Cemented tungsten carbide will give two or three times the production of high speed tool steel in those operations to which its use is adapted and over a given run will require about one-fifth the number of grinds that standard high speed tool steel will require."

2. This information is forwarded by direction, Wright Field letter, EAZ-ar-72-2, (July 9, 1942).

3. Any requests for further information should be directed to the AAF Chicago Area Office, 20 N. Wacker Drive, Chicago, Illinois, Attention: Production Section.

For the District Supervisor:

HARLEY S. JONES
Lt. Colonel, Army Air Forces
Technical Executive

CENTRAL AIR CORPS PROCUREMENT DIST. OFFICIAL WAR DEPT. DETROIT, MICH.

Distribution: 1-B
Manufacturers in CPD

NOTE:
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FIRTHITE

TUNGSTEN - TITANIUM CARBIDES

FOR STEEL CUTTING

T-04* Universal grade for heavy duty, interrupted cuts, and coarse feeds, on older machines.

TA* General-purpose grade for cutting steels under "average" conditions.

T-16* **The** grade for fine, extremely fast machining of steel.

T-31* Hardest, wear-resistant, premium grade for precision boring, etc.

***TITANIUM** in these FIRTHITE grades makes possible better, faster, cheaper cutting of steel and at the same time permits tool prices comparable with those for high-speed steel. These FIRTHITE grades are made under one or more of the following patents on **TITANIUM** Carbides: 1,925,910; 2,023,413; 2,246,387; 2,265,010; Re. 22,073; Re. 22,074; Re. 22,166; Re. 22,207.

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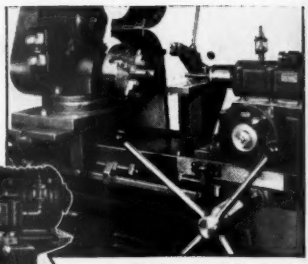
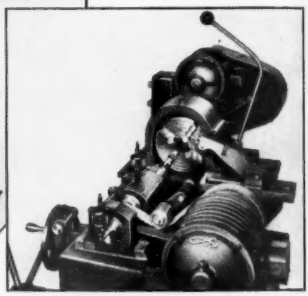


Angle view, work in chuck. Headstock graduated through 180 degree.



Looking down, from grinder head end.

Saw-way MULTI–PURPOSE INTERNAL GRINDER

View from headstock end, guard removed, showing step pulleys providing various speeds of work head. Headstock may be slid crosswise any distance up to 6".

Grinds holes ¼ to 18" diameter . . holes up to 9" deep, straight or tapered. Will handle a wider range of work than has heretofore been possible on any one model machine . . sturdily constructed throughout . . complete specifications, delivery and price on request.

Representatives throughout the U. S. A.

Saw-way INDUSTRIES

★ Machine Tool Division ★

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Eyes for our Submarines

By using simultaneously three separate carriage and apron units on the 22" Monarch lathe, accepting 40 feet between centers as illustrated below, a fast three-lathes-in-one job of machining marine tubes for our Navy is accomplished. With the tubes supported in five equally spaced steady rests, close tolerances are maintained without difficulty.

This example indicates how Monarch lathes are being used for fine accurate finishing of extra long work, such as gun barrels, ship-shafts and similar pieces. Whether the operation consists of straight turning, combined straight and taper or contour turning or boring, Monarchs do the job quickly and to required rigid tolerances.

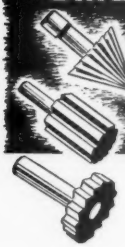
Monarch lathes are at work throughout our Naval and Maritime operations, speeding the building and equipping of ships.

THE MONARCH MACHINE TOOL COMPANY • • • SIDNEY • OHIO

MONARCH LATHES

COVER THE TURNING FIELD

NEW TOOL STEELS ARE Tricky Unless Accurately Heat Treated



USE
DESPATCH
FURNACES

for { TOOLS
DIES
PRECISION PARTS

Batch type furnace (gas or elec.); sizes 13" x 13" x 13" to 37" x 25" x 37".

Pot type Despatch recirculating convection furnace. Working sizes 8" x 12" to 60" x 60". Also special high temp. models.

"TRICKY" is just the right word for some of the new "NE" steels for tools and dies . . . unless you have a furnace capable of speedy, accurate heat-treatment.

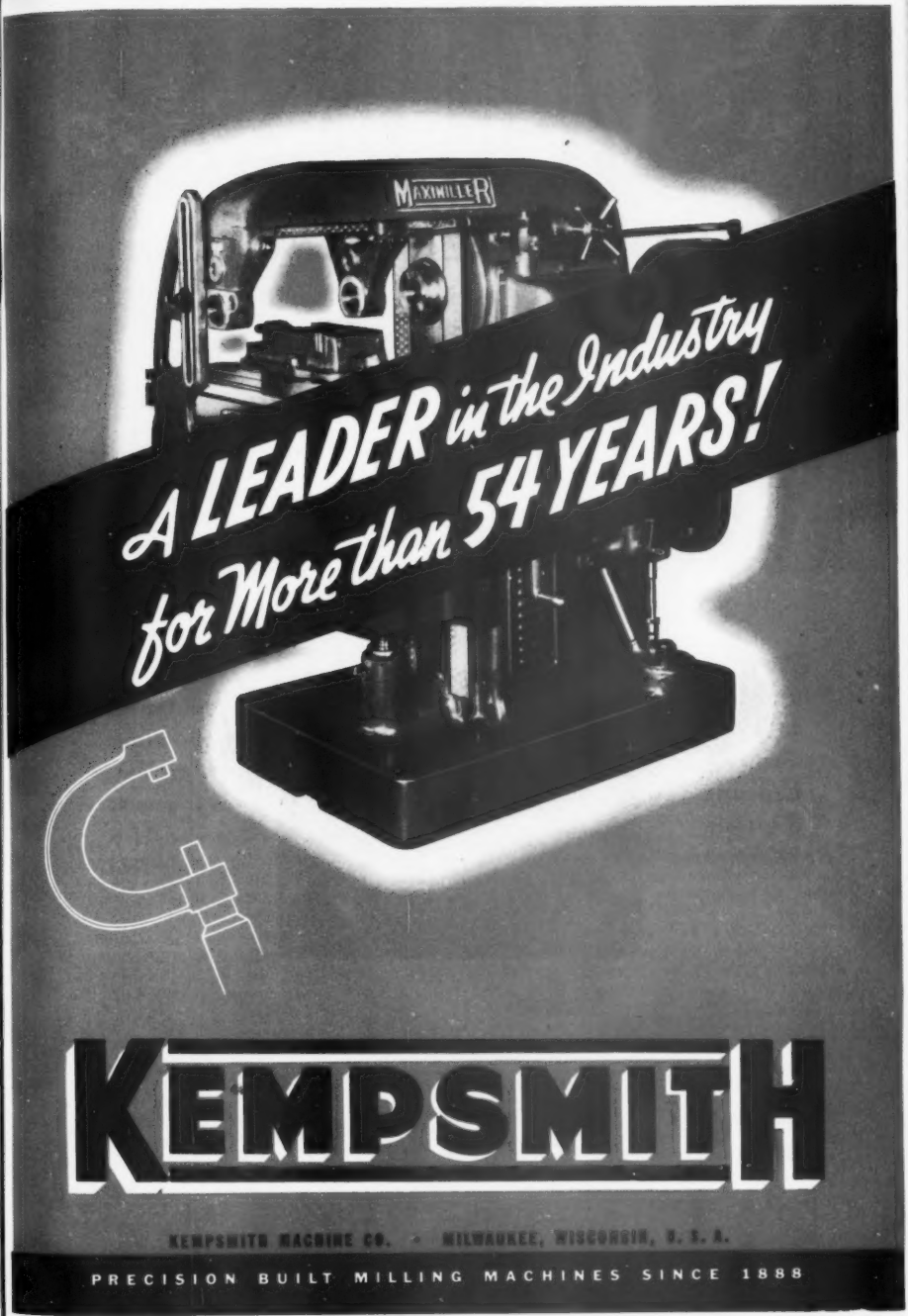
Despatch furnaces are excellent for this purpose. UNIFORM heat is guaranteed in chamber regardless of load size, with ACCURATE temperature control assured at any point in heat range 275° F.-1250° F.

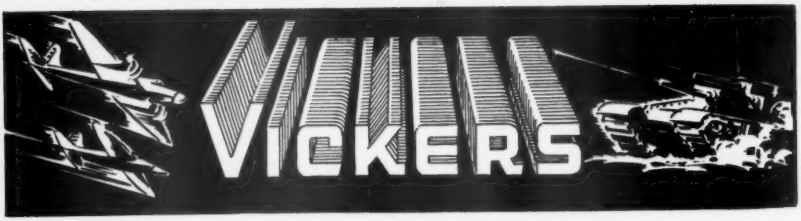
SPEEDY heat transfer and distribution increases efficiency, aids production.

FLEXIBLE for many processes; wide utility.

WRITE TODAY! Ask for Bulletin 81-O (pot type) furnaces; or Bulletin 83-O (batch type).

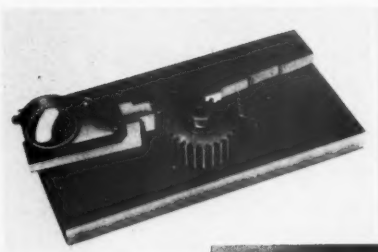
DESPATCH
OVEN COMPANY MINNEAPOLIS, MINNESOTA

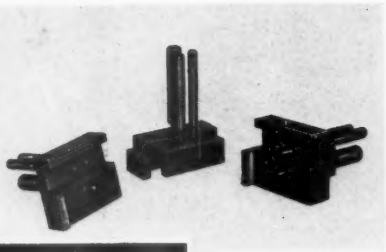

MAXIMILLER
A LEADER in the Industry
for More than 54 YEARS!
KEMPSMITH
KEMPSMITH MACHINE CO. - MILWAUKEE, WISCONSIN, U. S. A.
PRECISION BUILT MILLING MACHINES SINCE 1888



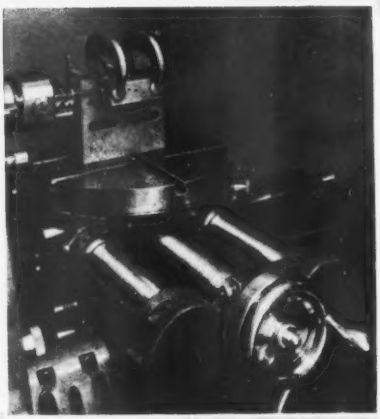
BROACH & GAGE CO.

1009-15 Franklin St. Detroit, Mich.

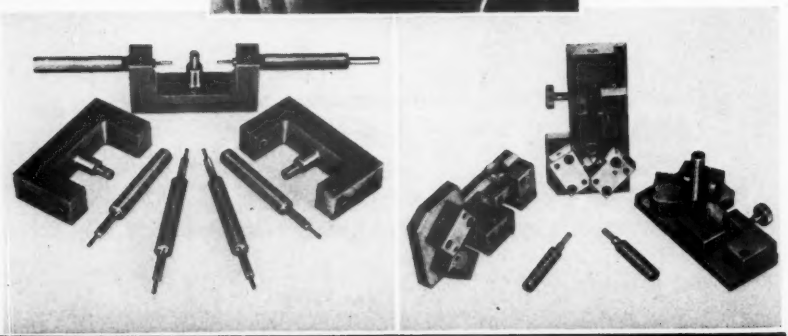




Precision Workmanship to Meet Today's Exacting Wartime Requirements.



Aid to the Factories that are Speeding Wartime Equipment to our Men in the Field.



MANUFACTURERS OF FINE BROACHES AND GAGES

Here is a *Portable* Coolant System

with large volume, fully controlled flow

CONTROLLED FLOW from 10 to 1000 Gal. Per Hour

SPECIFICATIONS

CAPACITY:	MOTOR:
Pump, 1000 G.P.H. Tank, 40 Gals. Size, 16x16x36 in.	¼ H.P.— 1725 R.P.M. Ball bearing.
PUMP:	**STANDARD EQUIPMENT:**
Centrifugal; high stress casting; sleeve bearings.	Flow control valve. Handy motor switch.

The New Gray-Mills HI-VOLUME *Centrifugal Pump*

NOW you can have large coolant-volume and high flushing capacity in a *Portable Coolant System.* Wherever you want the advantages of using coolants you can have them — on *all* your equipment—for *all* metal working operations like: grinding, honing, milling, cutting, tapping and threading.

The new Gray-Mills Hi-Volume Centrifugal pump, scientifically designed, specifically to handle coolants, will easily deliver 1,000 gal. per hour, or a controlled flow of any volume down to 10 gal. per hour. Here are some other important features:—A relief valve eliminates pressure build-up—The tank is fitted with baffle plates, for forced settling of abrasives and chips, to keep the coolant clean—Rugged, simple construction assures long trouble-free service — Horsepower consumption is low because efficiency is high.

Write for complete details on the New Hi-Volume Centrifugal and learn how easily you can use it wherever you need large volume coolant flow.

If any of your production equipment is handicapped in not being able to handle coolants, the answer is a Gray-Mills Portable Coolant System. In addition to the Hi-Volume Centrifugal of 1,000 gal. per hour capacity there are other coolant system models with capacities from 50 to 165 gal. per hour. We have the answer to your coolant system problems!

OTHER MODELS

Heavy Duty "A" Series 75 to 165 G.P.H.

Standard 50 to 130 G.P.H.

GRAY-MILLS

Complete Portable Coolant Systems
Flo-Bac Coolants, Pans and Fittings

GRAY-MILLS CO., 211 W. Ontario St., Chicago, Ill.

SHIRT-SLEEVE *Trouble Shooters!*

We're up to our necks in trouble these days — that is, other companies' troubles! We've made *their* war production problems *our* problems, and are helping to solve them with a speed and efficiency born of long experience.

Sometimes this involves designing special jigs, fixtures, dies or machinery — sometimes rearranging plant layout and routing.

But whatever the requirements, skilled McKinney men — engineers, designers and tool makers — team their abilities and experience to effect maximum production in record time.

Our recently expanded facilities and increased personnel now enable us to offer this helpful engineering service to more companies. May we quote on your requirements?

DEPEND UPON McKINNEY FOR:

- ★ Design and manufacture of dies, jigs, fixtures
- ★ Process Engineering
- ★ Tool Designing
- ★ Plant Layout and Routing
- ★ Product Engineering
- ★ Machine Designing

McKINNEY

TOOL & MANUFACTURING CO.

1688 ARABELLA RD. CLEVELAND, OHIO

"DESIGN ENGINEERS FOR TWENTY YEARS"

Number

22

NOW . . . A NEW STAR

for every Cutter and Tool Grinding Performance

New member of a long line of Covel Grinders, this No. 22 Universal Cutter and Tool Grinder moves into the spotlight for your inspection and approval.

FAST, ACCURATE and FLEXIBLE for TODAY'S TOOLS—and TOMORROW'S

So that you may have complete details and pictorial description of this greatest of Covel Cutter and Tool Grinders, an attractive booklet portraying the advantages of this truly universal machine is now ready for release. And when you see for yourself the scores of No. 22 advantages and advancements, you'll agree that here is the Cutter and Tool Grinder of tomorrow—ready TODAY.

Write, wire or phone Now for your copy of Bulletin TD122 and name of dealer nearest you. Early deliveries to Essential War Industries.

Grinding Machinery Since 1874

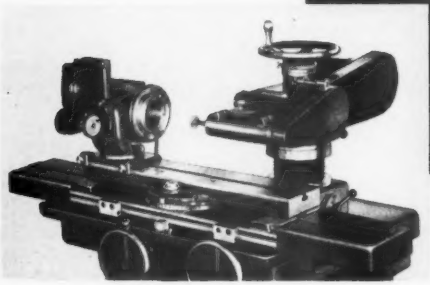
COVEL INDUSTRIAL GRINDERS

COVEL MFG. CO., BENTON HARBOR, MICH.

New VERNON UNIVERSAL tool and cutter grinder

Designed for fast accurate sharpening of milling cutters, reamers, hobs, and similar tools and for miscellaneous cylindrical and internal grinding.

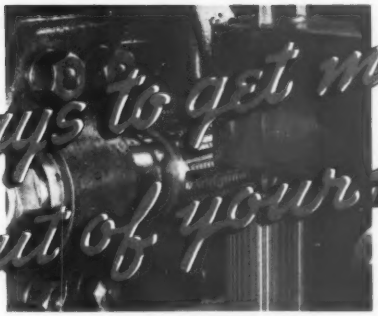
Extremely sensitive table action imparted by ball bearings rolling on hardened steel ways, which are ground in position. Table swivels 45° each side of zero setting.



Full line of attachments cover every tool room requirement. Ask for new bulletin!

MACHINERY MANUFACTURING COMPANY
1915 EAST 51 ST., VERNON · LOS ANGELES, CALIFORNIA
Vernon Line of **HORIZONTAL MILLS, VERTICAL MILLS & JIG BORERS, 11" SHAPERS & GRINDERS**

15 Ways to get more out of your Hobs



Hobbing a Zero-Backlash Involute Spline with MITCO Hobs.

ELIMINATING FLATS

Use of centralizing gages will not necessarily eliminate flats.

1. Best remedy usually is to increase the number of hob gashes.

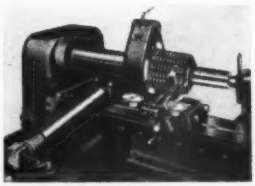
2. When cutting worm gears with small number of teeth, use tangential rather than infeed.

3. Check whether large lead errors were produced in grinding hobs incorrectly.

4. Hob runout or erratic flute spacing resulting from sharpening may cause flats.

5. Check also whether hob is mounted correctly in machine.

Hob Contour Checker



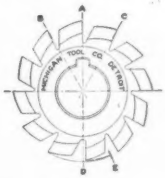
Hob Lead Checker

SHARPENING

A sharp hob cuts faster, with less power and wear, and will produce more accurate work with better finish.

1. Use a soft bevel or concave wheel of medium grain. Keep wheel clean as a glazed wheel may crack hob teeth.

2. When using ordinary tool grinders use a sharpening guide for spiral gashed hobs.



3. Grind hob tooth faces on centerline ("A" in drawing).

If undercut as at "B", hob tooth will cut too deep.

If ahead of center ("C"), tooth may drag on work.

If ground too far back ("D"), the tooth will be lower and gear contour will not be the same on both sides.

4. If a hob has a hook, be sure to maintain correct amount of hook as stamped on hub.

5. Check your ground hob on accurate equipment.

For further information on hobs and hobbing write on your company letterhead for Booklet 149-A.

CORRECT SET-UP

The selection of the best cutting zone in a given hob has a tremendous effect on hob life, product accuracy and overall output.

1. Be sure there is no endplay of hob on arbor.

2. Be sure outer bearing is in place before clamping hob on arbor to prevent its springing out of line.

3. Check hub diameters with indicators graduated in ten-thousandths. Runout should not exceed 0.0002 in.

4. If runout exceeds this amount, loosen the clamping nut and rotate spacing collars to correct, these collars usually having slight errors in parallelism.

5. It is possible to select more than one "best" position of a given hob, by shifting it axially.

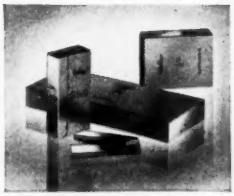
Hob Sharpening Checker

MICHIGAN TOOL COMPANY

7171 E. McNICHOLS ROAD . . . DETROIT, U. S. A.

WE *MUST* HAVE GAGE BLOCKS TO WIN THIS WAR!

WHAT ARE GAGE BLOCKS?



Except for the men who use them, few people know what Gage Blocks are. Briefly, they are small pieces of special steel accurate to a few millionths of an inch. These blocks are the basis of all precision measurements, furnishing the standard or pattern from which measurements used in manufacturing processes are taken. A simple illustration is this comparator being set against gage blocks. The comparator will then be used to check precision aircraft parts in production.

Why Are Gage Blocks So Vital To War Production?

Mass production of war goods is made possible through development of the system of interchangeable manufacture. This term simply means that parts to be assembled into a complete unit—engine—gun—torpedo, etc., etc., can be manufactured with such uniform accuracy that any part can be interchanged with any other and the unit assembled from any group of parts without first selecting them to fit together.

To achieve this uniform accuracy of parts some constant unit of measure to serve as the basis of all precision measurements had to be found. The answer is gage blocks.

The entire system of interchangeable manufacture which alone makes possible our mass production of tanks, planes, guns, shells, ships, etc., etc., would not exist today —if it weren't for gage blocks.

We just wouldn't have any "War Production" if these little pieces of steel didn't exist.

How Are Gage Blocks Made?

Gage Blocks were introduced into the U. S. about 30 years ago. Since then only three outstanding manufacturers of this unique product have arisen despite a constantly

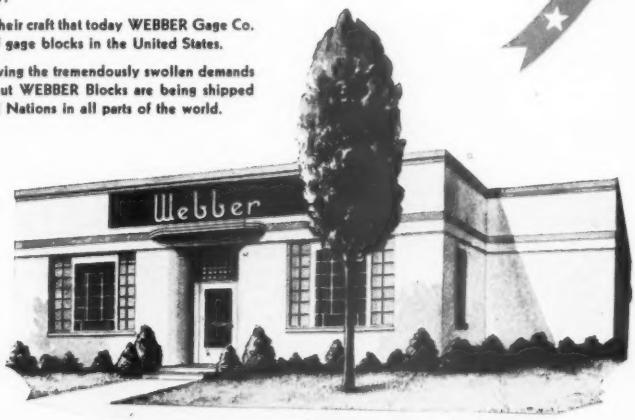
Webber

growing demand. Why should this be? The answer lies in the fact that the basic requirement of successful gage block manufacture is skill—or good old fashioned craftsmanship. This skill can only be acquired slowly, almost painfully and there is no substitute for it in the making of these fantastically accurate pieces of steel.

★ In the WEBBER "Home of Precision" the Webber —father and son—apply their two generations of craftsmanship with the aid of a complete staff of skilled artisans in producing gage blocks of a high quality and precision as the world knows today.

So well have they plied their craft that today WEBBER Gage Co. is the largest producer of gage blocks in the United States.

Not only is WEBBER serving the tremendously swollen demands of U. S. war industries but WEBBER Blocks are being shipped regularly to other United Nations in all parts of the world.



GAGE COMPANY

12903 TRISKETT RD. • CLEVELAND, OHIO

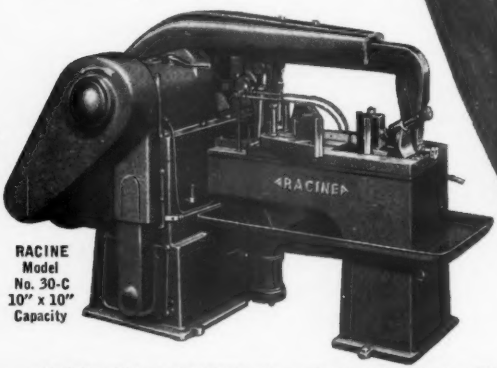
WHICH CUT *is Yours?*

TRUE . . . OR FALSE?

Stepping up production needs more than just speeding up the sawing in your cut off department. Your production line can not save the time gained by sawing stock faster without receiving smooth accurately cut pieces . . . each piece to the correct machining length. Machining down crooked cuts will waste valuable time and add critical metals to your scrap pile.

RACINE Heavy Duty Hydraulic Saws are precision designed to cut accurately at high speeds. Each machine has a massive saw guide to tension the saw blade. Wide bearing areas contained in the saw frame provide rigid alignment under heavy cutting feeds to maintain accuracy in cutting material from 10" x 10" up to 14" x 20". Such accuracy means safer, faster cutting.

Write for information on our complete line, 6" x 6" up to 14" x 20" and also on our fully automatic machines.



RACINE
Model
No. 30-C
10" x 10"
Capacity

RACINE TOOL & MACHINE CO., 1768 State St., Racine, Wisconsin

RACINE METAL CUTTING MACHINES

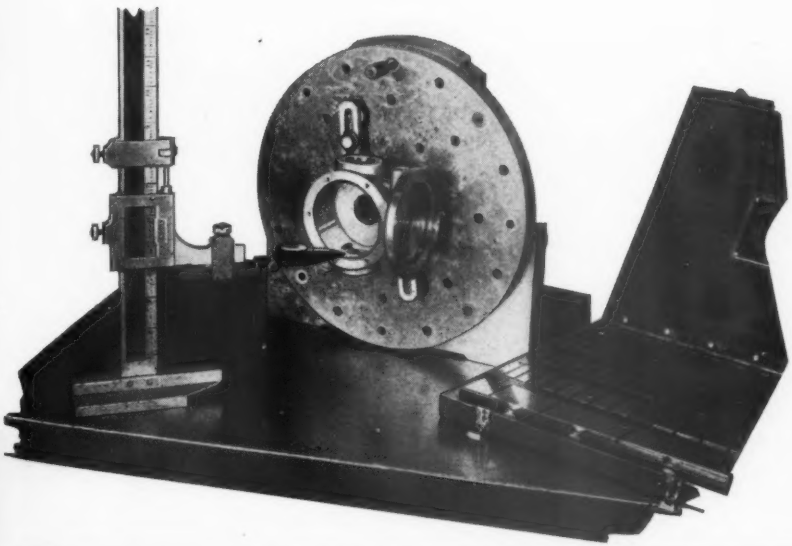
The right answer - - ALWAYS

The BECKER INDEX MASTER does not make mistakes. It is a precision unit all the way through . . . and does precision work all the way through. Whatever the part —aircraft, navy or ordnance —you can be sure that the BECKER INDEX MASTER accurately and speedily determines its conformance with drawing specifications.

Comparing the present methods used in the inspection and layout of tools and parts where a bevel protractor sine bar must be set for each dimension, you can readily see the great advantage of using the BECKER INDEX MASTER—which saves valuable time.

A new descriptive circular on the BECKER INDEX MASTER is available. Address:

THE BUNELL MACHINE & TOOL CO.
1601 E. 23rd St. Cleveland, O.



Two Norton Machines
for Tool Room Surfacing Jobs

THE 6 x 18" Hydraulic Surface Grinder is equally adapted for grinding single pieces or production lots. Available options of spindle construction, drive and equipment add to its efficiency for specialized applications.

The versatile Norton No. 10U Lapper will accommodate a wide range of gauges and tools. While advantages of accuracy and uniformity obtained by machine lapping were previously recognized, the quantities of many tools did not justify this method. Today's requirements demand it. Being well suited for lapping plated surfaces, this machine fits into the tool rebuilding programs of progressive shops.

NORTON COMPANY
Worcester, Mass.

M-450

PRECISION

SCREW MACHINE PARTS

53 YEARS EXPERIENCE

★ **TODAY** the C. M. Smillie Company is fulfilling its promises to our country by increasing their production so that deliveries can be made on time to help our boys over there.

★ **TOMORROW** the C. M. Smillie Company will again fulfill their promises to their peacetime customers.

C. M. SMILLIE & CO.

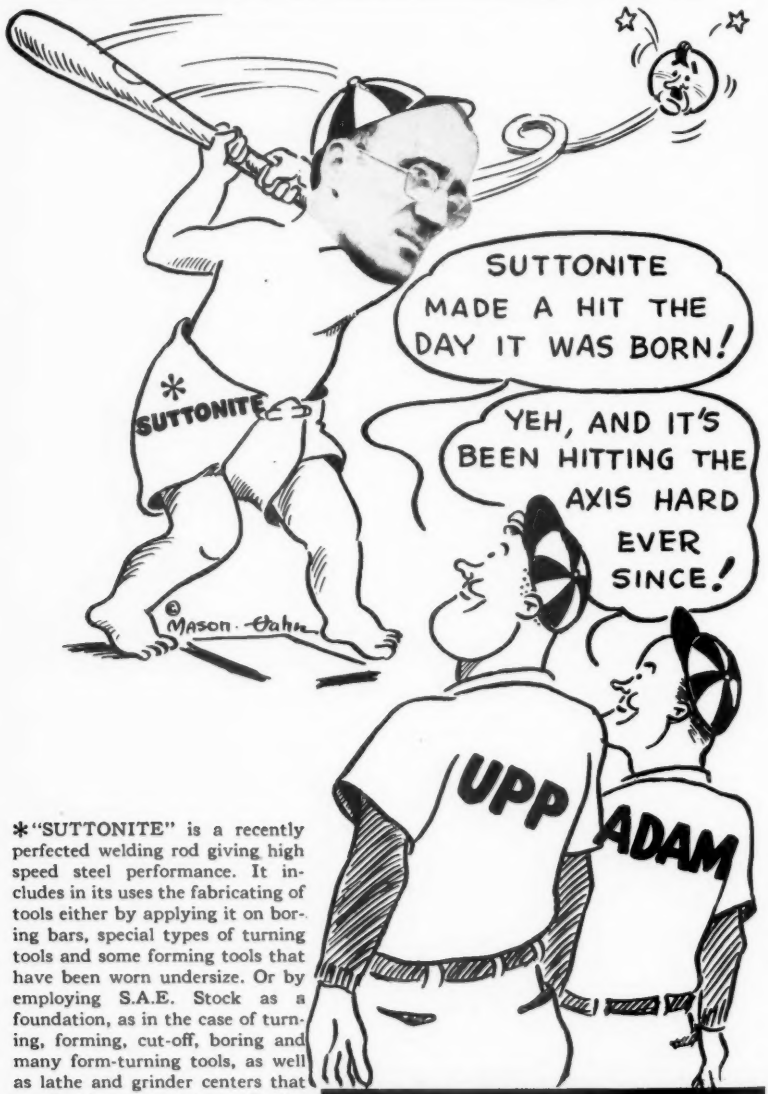
1108 WOODWARD HGTS., FERNDALE, MICH.

OUR EQUIPMENT FOR *PRECISION* WORK

★ GRINDING		MACHINING		★ INSPECTION	
Internal	4	Horizontal Mills	3	Rockwell	2
External	3	Vertical Mills	2	Comparater	3
Surface	4	Hand Mills	4	Shadowgraph	1
Rotary	1	Lathes	3	Gage Blocks	6 sets
Centerless	1	Shapers	1	Plugs - Thread Gages	
Honing	1	Drill Presses	8	Micrometers	
★		Tapping Presses	2	★	
		Broaching	1		

TOOLS AND FIXTURES

UPP and ADAM *Broadcast No. 1003* • • *by* Mason-Hahn

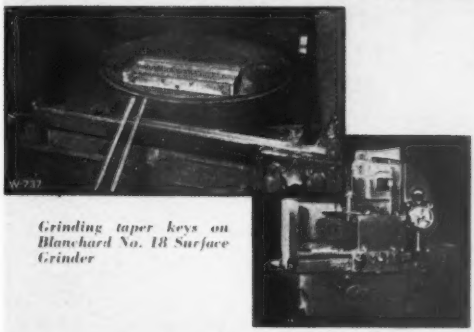


*"SUTTONITE" is a recently perfected welding rod giving high speed steel performance. It includes in its uses the fabricating of tools either by applying it on boring bars, special types of turning tools and some forming tools that have been worn undersize. Or by employing S.A.E. Stock as a foundation, as in the case of turning, forming, cut-off, boring and many form-turning tools, as well as lathe and grinder centers that require abrasive resistance. It also serves many other useful purposes.

Inquiries are solicited on any prospective jobs.

WELDING EQUIPMENT & SUPPLY CO.
226 Leib Street • DETROIT, MICHIGAN

"PUT IT ON THE BLANCHARD"



Grinding taper keys on Blanchard No. 18 Surface Grinder

EVEN though fixtures are sometimes necessary on a Blanchard Surface Grinder, a simple design is often very satisfactory. A simple tapered shoe is used for holding 16 tapered keys in the set-up shown above. ¼" to ½" of stock is removed from one side of each key to limits of .002". 48 pieces are ground per hour.

If greater production is required, two fixtures could easily be accommodated on the 36" magnetic chuck. Magnetism holds the fixture on the chuck and helps to hold the work down in the fixtures.

The BLANCHARD MACHINE COMPANY
64 STATE STREET, CAMBRIDGE, MASS.

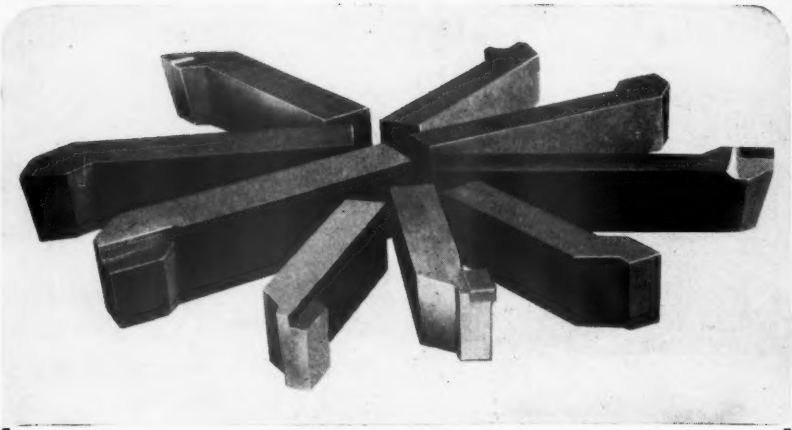
BLANCHARD

CHECK THESE ADVANTAGES OF BLANCHARD GRINDING

- ★ **Production**
- ★ **Adaptability**
- **Fixture Saving**
- **Operation Saving**
- **Material Saving**
- **Fine Finish**
- **Flatness**
- **Close Limits**

. . . . . *Especially valuable on jobs like the one illustrated.*

Send for your free copy of "Work Done on the Blanchard." This book shows over 100 actual jobs where the Blanchard Principle is earning profits for Blanchard owners.



There is No Scarcity of Victory Tool Shanks

Cast of tough Meehanite Metal, they outperform and outlast hard-to-get carbon steel

For any shop equipped to tip its own cutting tools, Victory Tool Shanks offer these attractive advantages:

1. They have double the vibration damping capacity of steel.
2. Their heat dissipation is far superior to that of steel.
3. The coefficient of expansion of Meehanite is closer to carbide than is steel.
4. They require a minimum of machining before use.
5. They are available NOW.

Victory Tool Shanks are stocked in many standard sizes and shapes. Special shapes can be cast to your specifications.

WRITE FOR BULLETIN No. 52T-1 which shows sizes and prices. Pick out a size you can use and ask for free samples. Small quantities can be shipped within a few hours after receipt of order.

THE COOPER-BESSEMER CORPORATION
Sugar Street, Mount Vernon, Ohio

Cooper-Bessemer

FROM BLUEPRINT INTO METAL IN 60% LESS TIME!

Machines, Accessories and Attachments for a Wide Variety of Needs

Rotary Head Milling Machine

Autometric Jig Boring Machine

Milwaukee Midgetmill

Milwaukee Speedmill

Milwaukee Face Mill Grinder

Center Scope

The Center Scope in Operation

The job illustrated above typifies the unusual performance of the Milwaukee Rotary Head Milling Machine. The permanent mold (cast iron) for aluminum shown above was produced in *60%* less time than it previously required — without models or templets and directly from the blue-print into the metal.

The Milwaukee Rotary Head Milling Machine is without equal in the high speed, accurate, economical production of dies, molds, hobs, as well as the precision machining of many parts. In a single setup, it performs layout, milling, drilling, precision boring and slotting operations—mills circular and angular cuts in both vertical and horizontal planes. *Send for Bulletin 1002 A.*

YOU'RE ON THE BEAM WITH CENTER SCOPE ★

The CENTER SCOPE is an optical locating machine shop tool, constructed for use on any machine. Greater accuracy is obtained on the initial setting when used on precision jig borers — precise individual locating rapidly obtained on lathes, milling and boring machines, etc.

The optical beam, or line of sight, is absolutely inflexible and can never be distorted. There is no pressure on the object to be viewed and it is not subject to any mechanical errors.

Production is too vital — metals too essential — to risk the waste of both because of inaccuracies in machining. With the CENTER SCOPE you SEE the exact location of the spindle axis, you can set up and hold tolerances to "within a tenth", you can compensate for spindle run-out —and maintain absolute accuracy for the set-up.

The CENTER SCOPE is a necessary production tool necessary today because you are interested in saving time — tomorrow because you'll be interested in saving costs.

THREE TYPES TO CHOOSE FROM

The variable and rotating Center Scopes are priced at $97.00, with taper shank $125.00. The Special Center Scope sells for $125.00. Edge Block $23.00 additional.

Write Dept. CS for complete information.

KEARNEY & TRECKER PRODUCTS CORPORATION
Milwaukee, Wisconsin

Kearney & Trecker Products CORPORATION
Subsidiary of Kearney & Trecker Corporation, Milwaukee, Wis.

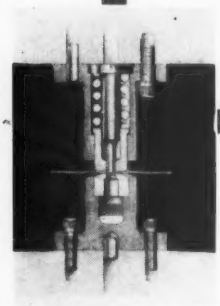
How to make multiple hole punching dies in "***Nothing Flat!***"

Buy a standard die set and add

WALES

COMPLETE CD UNITS

wherever you need a hole punched



Above cross section of Wales CD Unit shows stripper spring and location of pilot pin in die holder.

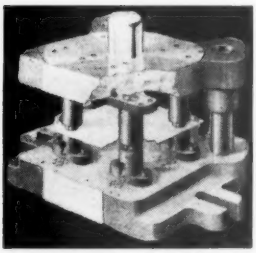
Wales CD Units are sets of punch and die units.

The punch unit half contains a punch with a pilot, a holder, a stripping spring and a guide. The die unit half consists of a holder with a slug clearance chute and a die. These revolutionary units provide new time saving and money saving features. The amount of assembly work is practically nothing.

Every punch and die is easily accessible for quick replacing of dulled parts without breaking down entire die set. "Down time" is practically eliminated with Wales CD Units.

TWO NEW SIMPLIFIED MOUNTING METHODS are fully described and illustrated in Catalog CD. Write for your copy today.

Remember, "There's Always Something New in the Wales Line,"—this month it's Wales "CD" Units. Keep posted by writing to—



Cutaway view showing four CD Units and back gauges mounted on conventional die set.

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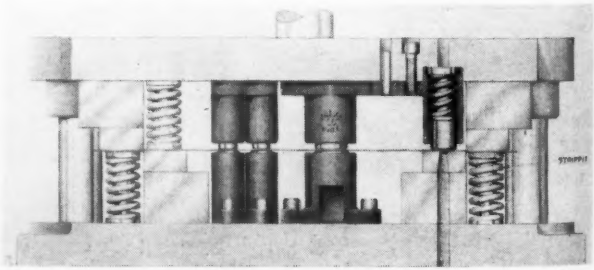
George F. Wales, President

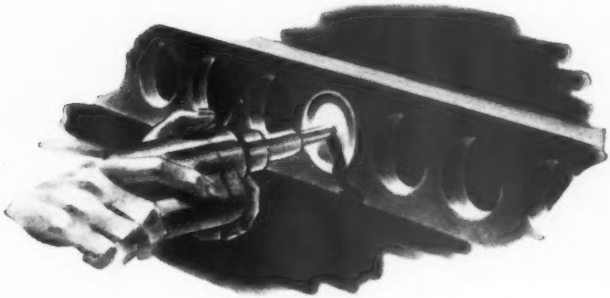
Specialists in Punching and Notching Equipment



Cross section view showing typical die set with Wales CD Units.

SLOTTED ABRASIVE DISC SPEEDS BURRING OF HOLES

Grinds top and bottom edges of holes to true radius — all in one operation



THE job of removing the burr and producing the true radius required on all holes in aircraft engines has been greatly simplified by the introduction of the slotted abrasive disc. Made of Aloxite Brand Electrocoated Aluminum Oxide Metal Cloth, these discs are being widely used for burring and polishing all metal hole edges, from $\frac{3}{8}$" to $5\frac{1}{2}$" in diameter.

The speedy performance of the disc is a result of the flexibility achieved by its slotted design. Using a disc proportionately larger than the diameter of the hole, mounted on a spindle for use in a portable electric or air-driven tool, the operator presses it against the edge of the hole, as in the diagram below. Accommodating itself to the opening, the disc "cones" backward, sanding only the edge of the hole, leaving the flat surface untouched.

If both ends of the holes are to be finished, two discs mounted back to back are used. They are first pushed through and then pulled back against the opposite edge of the hole.

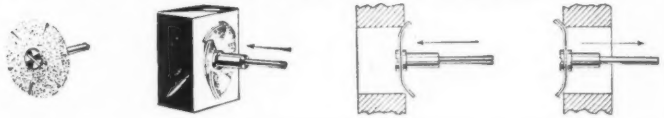
Uses for this new abrasive "Weapon for Production" are many and varied. Such parts as valve rocker arms, connecting-rods, tappet guides, oil holes etc., having openings larger than $\frac{1}{16}$", are typical of its wide application.

In ordering slotted abrasive discs, it is important to select the correct grit for the kind of metal employed and the finish required.

If you care to try a few of these slotted discs we will be glad to send them free of charge. Simply address your request to Dept. TD, The Carborundum Company, Niagara Falls, N. Y.

CARBORUNDUM ABRASIVE PRODUCTS

DIAGRAMS SHOW HOW SLOTTED DISC WORKS



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HOW TO GET THE MOST OUT OF YOUR LATHES

No. 3 in a series of suggestions made by the South Bend Lathe Works in the interest of more efficient production

Keep Your Lathes Level

The leveling of a lathe can either perpetuate or destroy the best craftsmanship of the machine tool builder. A lathe that is not level cannot turn out precision work. Any twisting of the lathe bed will throw the headstock, tailstock and carriage out of alignment. This will cause the lathe to turn a taper instead of taking a straight cut.

Check every lathe periodically to see that it is level

Check Leveling Frequently

The major cause of distortion in lathe beds is the settling of the floor supporting the lathe. There are other conditions which can also affect this. Therefore, check every lathe periodically to see that it is level.

How to Level a Lathe

The first requisite for accurate leveling is a precision level at least 12 inches long. One that is sufficiently sensitive to show a distinct movement of the bubble when a .003" shim is placed under one end of it.

The leveling of the lathe is tested by placing the level squarely across the lathe bed at both ends. Metal shims should be used under the lathe at the points indicated by the level as being low. After all adjustments have been made, bolt the lathe securely to the floor and repeat the tests to make sure that the lathe is still level.

A reliable leveling test can be made by placing a short bar of 1" steel in the chuck and machining two collars of equal diameter 4 inches apart. Then, take a very light finishing cut across both collars. Measure both collars with a micrometer. If the collars are not the same diameter it is an indication that the lathe is not level. Adjust the leveling until both collars can be turned the same diameter.

Write for Bulletin H3

Bulletin H3 giving more detailed information on the installation and leveling of lathes will be supplied on request. Also, reprints of this and other* advertisements and bulletins in this series. State quantity wanted.

*Ad. No. 1, "Keep Your Lathe Clean"
Bulletin H1, "Keep Your Lathe Clean"
Ad. No. 2, "Oiling the Lathe"
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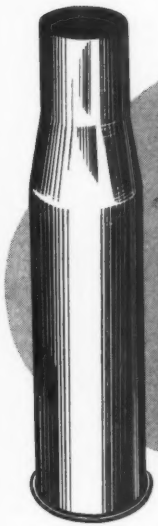

SPEEDING
Steel Shell Production

Gilron compounds are now doing a real job drawing steel cartridge and shell cases. Aiding in the development work, Gilron engineers have been instrumental in increasing production for leading manufacturers.

20 mm to 105 mm steel shell cases can be produced with the new water soluble non-toxic coating compound, thus eliminating copper plating.

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A convincing list of satisfied users will be furnished on request, together with complete production details.

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TECO Carbide Dies provide a tried and proven way to step up your output of cartridge cases. To convince yourself, equip a few machines with TECO Carbide Dies—then check the quality and quantity of your production against previous runs. Our engineers will gladly discuss your needs.

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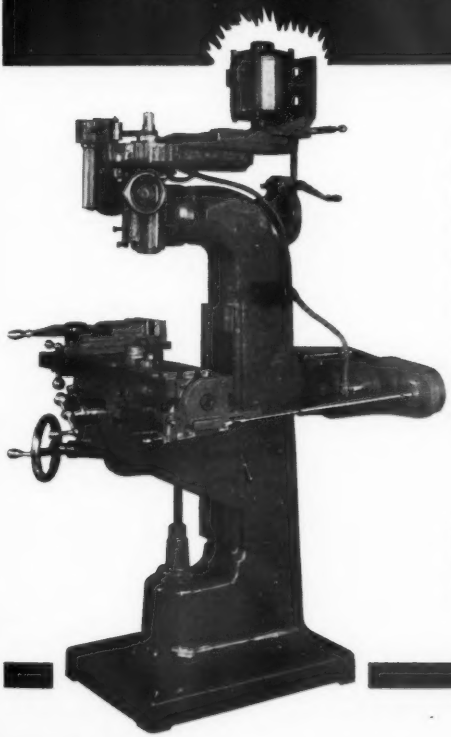
Vernier Precision

FOR MILLING, DRILLING AND BORING ON TOOLS, DIES, EXPERIMENTAL AND PRODUCTION WORK



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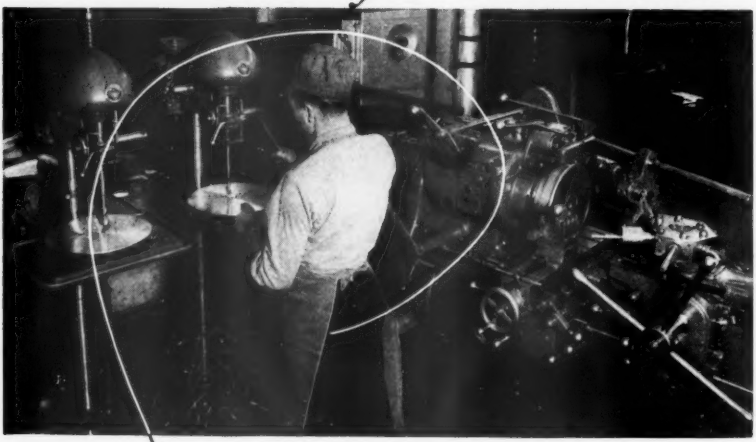

The *portability* and *flexibility* of Delta machines open many roads to increased production: Here illustrated are two 14-inch Delta Drill Presses set up alongside a screw machine. Operator performs two hand-feed operations on drill presses while waiting for power-feed on screw machine.

Other examples: When five drilling and tapping operations are required, a single spindle Delta Drill Press is moved alongside a four-spindle drill press . . . to save toolmaker's walking and waiting time, individual Delta Drill Presses, Grinders and Band Saws are set up alongside each toolmaker's bench.

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THE W·P·B·SAYS:

begin receiving their occupational questionnaires in June, Selective Service headquarters said.
Salvage Plan Urged By WPB Unit Here
Concerns in this area are being asked by the state office of the War Production Board in Hartford to salvage various tools, dies and imperfect articles through plating.
In making gun parts or other armament, the WPB points out, there are apt to be errors in machining that will throw out a costly piece. In most cases, it adds, the error can be corrected by "building up the lost metal with chromium" and then grinding it to proper dimensions.
Reconditioning tools and dies in this manner, the office said, will save both time and expense for the firm.
Bond Pledge Officials To Meet Here Tonight
SALVAGE OLD TOOLS WITH HARD CHROME PLATE

Hard chrome plate is worth its weight in gold, when it can salvage indispensable tools and dies. And its value is incalculable when, by speeding production, it can save the lives of our fighting men.

Before you consider it "impractical" to recondition a tool or die, check with Hartford Chrome. Hard chrome plating has made much progress since the war. Yesterday's tough problems are ordinary production jobs now.

Our standard of work applies to Naval Aeronautical Specifications P-44. Our efficient operation enables us to maintain a low price schedule. Inquiries for estimates will be given immediate consideration.

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"What— no extra Calipers?"

Yes, plenty of extra pairs . . . thanks to a Distributor's salesman who knew where to look

He was new in the place—his first job was checking odd lots of shafting. All ready, except for calipers—not a pair to be found.

"Hey, loan me your calipers" he yelled across to the next man—"what kind of a place *is* this that doesn't have scads of 'em in easy reach?"

But that man's calipers couldn't be spared. In fact, it finally developed that no dealer in the city had any in stock. But as usual—

The representative of an Industrial Supply Company happened to know where he could pick up a box of brand-new ones that the owner didn't need and was willing to sell. Everybody happy!

This incident is typical of the unusual services that many Mill Supply Distributors are rendering their customers during the Emergency.

The Representatives of *your* nearby Industrial Supply Houses not only can do a "Sherlock Holmes" helping you unearth scarce materials now and then, but can lend your short-handed Purchasing Department valuable help in other ways besides.

You can call in their help with full confidence—because they are our own Industrial Distributors, selling Cle-Forge High-Speed Drills and Peerless High-Speed Reamers throughout America during many years.

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THE TOOL & DIE JOURNAL

DECEMBER, 1942 VOLUME 8, NUMBER 9

Christmas, 1942

Letter from Washington by George J. Huebner

"On earth peace, good will to men" has been the Christmas theme for centuries. With total war engulfing the world, should it this year be different?

True it is that men, women and children are being taught unnatural philosophies and in some nations "to hate" is held up as man's requirement to attain the fuller life.

But let no man be deceived. None of these weirdly adverse theories will ever bring peace or joy or the fullness of life to any man or to any nation.

Too long, outlaws have laid waste the homes and cities of decent peoples and killers have stalked the peaceful hills and valleys of the world. Nations with right ideals have had to band together to stop them, aye, to exterminate them if necessary.

And how can we look upon such a picture of carnage and destruction and even think of good will, or how can we contemplate the death dealing implements our sons and brothers and husbands and fathers are being called upon to make and to use, and think of peace?

Every American man and woman should know the answer and their children should be taught it. Thus the record of history will always be kept straight.

We *believe* in the Christmas Spirit. It is both the essence and the fulfillment of the American way of life. We have learned that great joy and satisfaction and success come when good will prevails inside our borders and peace without.

We do not deny that American "Free Enterprise" encourages competition and engenders rivalries and that every man must claim his heritage of freedom from exploitation and repression of every sort by climbing out of the shadows to his place in the sun, but it is accomplished along the highways of peace and good will.

Why then abandon the Spirit of Christmas? No good for any one is to be achieved by substituting gloom and frustration for joy and good wishes. In fact it is proven that we as individuals, humanly and spiritually, thrive on encouragement and right thinking. Daily accomplishment is greater because morale is higher and health itself is benefited. Thus we accelerate our part in the war program.

And lastly—who will dispute that our men on the war fronts should have the strongest assurance that good will reigns among us here at home and that our daily prayer is that peace may soon come again to this world.

Only then will they be able to come home and take their rightful places in the rebuilding of a world on the only permanent foundation known to God and man;

"On earth peace, good will to men."

Hard Chrome Plating Aids War Effort

War demands have caused a shortage of metal necessitating the preservation of present equipment as well as the reclamation of prospective scrap. Hard chromium plating has been instrumental in alleviating these two conditions. The WPB has strongly advocated the use of hard chromium in maintaining the efficiency of new parts and the salvaging of old tools, dies, gages, machine parts and imperfect production work.

by Arthur W. Logozzo
Research Engineer
Hartford Chrome Corp.

A STUDY of the physical properties of electrodeposited chromium instantly reveal why it is so desirable to the manufacturer. Its hardness is comparable to the hardest of metals, ranking No. 9 on the Mohs scale, second only to diamond. A remarkable resistance to heat, nonoxidizing up to somewhat better than 1200° F enhances its desirability. A lower coefficient of friction than any other metal lends to a longer wearing life. Chromium is inert in ordinary atmospheres, giving it excellent corrosion resistance, particularly when the thicknesses range upwards of one thousandth of an inch. It is white in color (with a bluish tint), dense in crystalline structure when properly applied and not at all ductile because of its extreme hardness. A combination of this type will not be found in any other metal.

Intensive Study Necessary

Like any other successful industrial application, an intensive study has been required to develop hard chromium to its present position in the field of electrodeposition. The direct application of metal-upon-metal involves three distinct steps: first, the chemical angle involving cleaning, pickling, bonding and plating; second, the electrical setup involving intricate control for all-around optimum results; third, the mechanical features essential to proper preparation of the surface, the stopping off of areas not to be plated and correct cathode to anode relationship. Unlike most plating, which merely requires the hanging of parts between flat anodes hung on each side of the tank, hard chromium employs auxiliary anode setups for each job.

Use of Hard Chrome

The uses of hard chromium have few limitations. Figure 2 represents a miscellaneous group of parts picked at random from the receiving bench. Included are all types of machine parts, gages, dies, molds and broaches. The requirements of this collection include the plating of outer and inner diameters, gears, insides, tops and bottoms of splines—male and female.

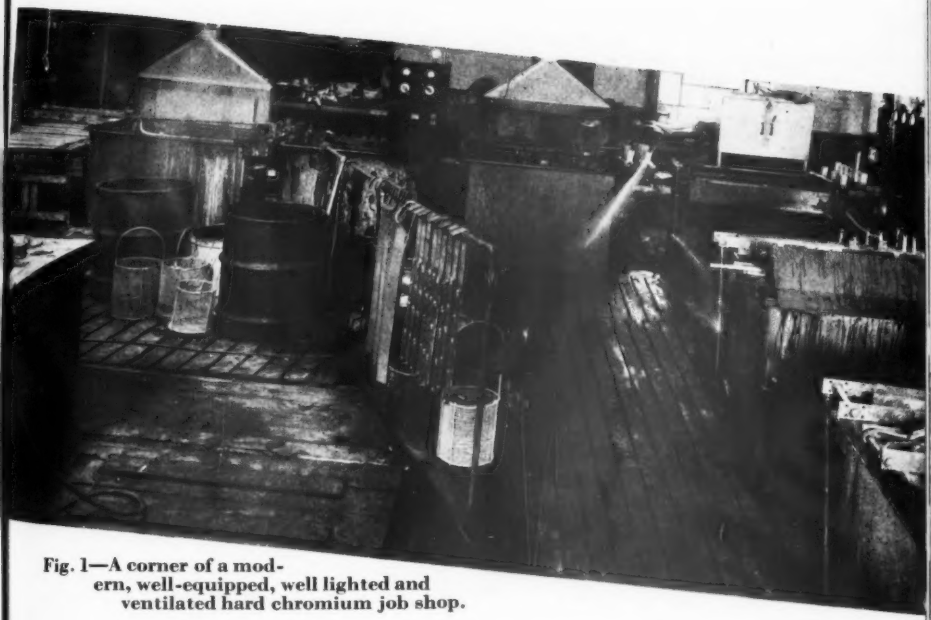
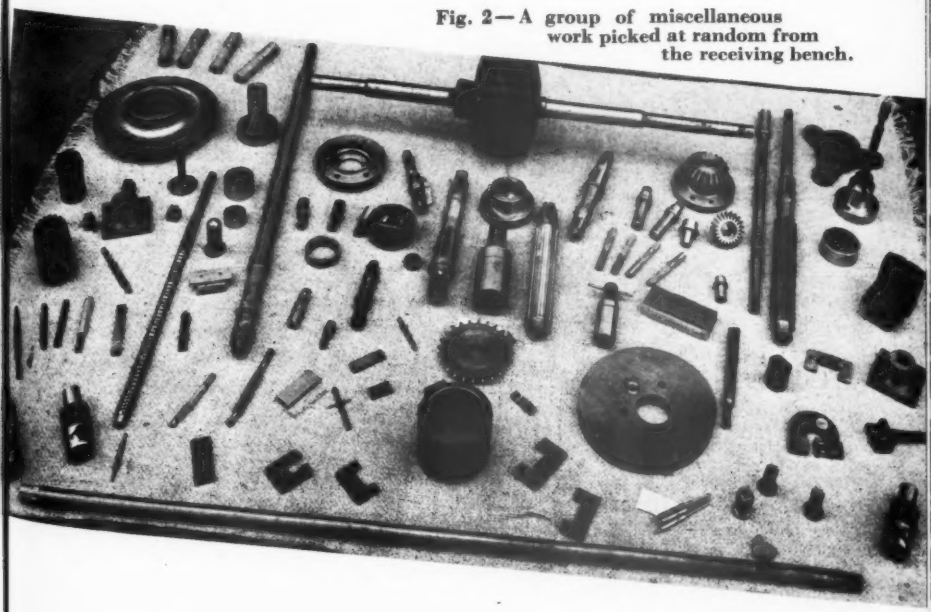


Fig. 1—A corner of a modern, well-equipped, well lighted and ventilated hard chromium job shop.

Fig. 2—A group of miscellaneous work picked at random from the receiving bench.



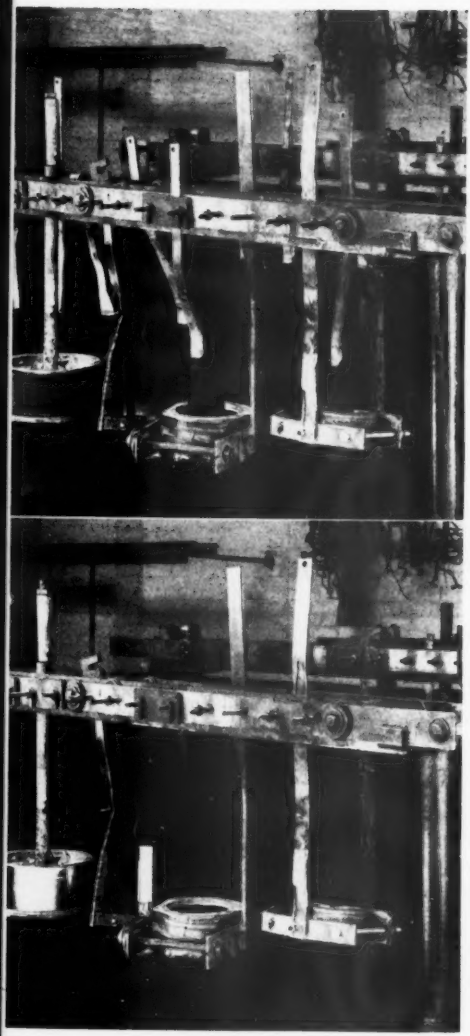


Fig. 3 (top)—A bar of work as it appears after its removal from the plating tank with the mechanical setup intact. Some plated O. D. and I. D.

Fig. 4 (bottom)—The same bar with the anodes removed. Note smooth, lustrous, pleasing appearance despite the fact chromium deposit is over .010".

Practically all concerns doing any drawing of copper, brass and steel go all-out on the chromium plating of their dies and punches. The plate thickness for optimum results ranges from .0015" to .002". This coating of hard chrome is applied to the new punches and dies and gives from three to five times the life of the unplated steel parts.

When the coating shows signs of wear, it is stripped and replated. Thus, for the price of plating, you have a new punch and die. Forging dies, particularly when aluminum is the metal being forged, have a bad habit of picking up and fouling. A good, polished chrome deposit of .001" thickness will eliminate sticking and prolong the life of the die.

Blanking dies have been known to last ten times longer and operate more efficiently when plated with .0005" thickness of chromium.

Gages of all types (see Fig. 5) are now being plated by all the leading gage manufacturers in the country. These parts are usually ground .002" to .003" undersize, plated .003" oversize, then ground and lapped to size.

Comparative tests reveal that gages of this type give from three to seven times the wear of the best gage steels and, at the same time, wear more uniformly. When chrome plated gages are worn below the dimensional limits, they are stripped, replated and refinished. Some companies have been using the same gages year in and year out by employing these methods.

The all important aircraft engine manufacturers have come to rely heavily on hard chromium in salvaging expensive machined parts (see Fig. 6). Careful handling of parts as well as perfect

stopping off of areas adjacent to diameter to be plated, make hard chrome invaluable and inexpensive to the aircraft manufacturer.

Spindles and shafts for any type of machine are nicely handled by hard chrome plating worn areas. In addition to salvaging the piece, it also gives a more durable and longer lasting part. The worn and scored sections are ground uniform when necessary, plated oversize and ground to size. The beauty of salvaging "hard-to-get" machine parts of this type is that keyways, slots, threads and other important sections of these parts are thoroughly protected and unaffected in any manner. (See Fig. 7.)

The plastics industry, one of the up and coming branches of the modern manufacturing world, is already leaning heavily towards the hard chromium plater for preservation of his expensive tools and dies. The plastics mold receives terrific abuse. Harsh abrasive action caused by rag, cotton flock, asbestos, graphite and a score of other fillers; chemical reaction from phenols, ureas, etc.; high temperatures causing constant oxidation and extreme pressures are the sources for this abuse.

Present naval specifications call for all plastics molds to be hard chrome plated. The largest manufacturers of plastics pieces already have ordered all molds be plated before being put into production.

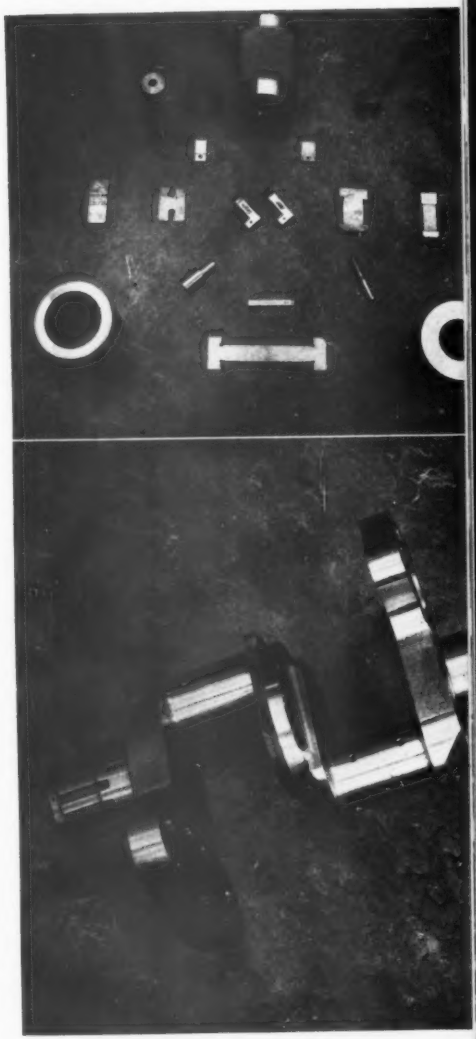
A thickness of chromium of .001" applied directly to the base metal (as in all hard chromium plating) will usually last the life of the mold. Heavier deposits, up to .005", are applied to larger molds such as those used in the manufacture of lamp shades, adding machine cases, radio cabinets, coffee grinder housings, etc. This additional thickness is used because of added pressures, increased flow and more wear. Pin breakage is reduced considerably by plating to eliminate fouling.

A brief summation of some advantages of plating plastics molds are as follows:

1. Eliminates breaking in time of new mold because of low coefficient of friction of chromium surface.

Fig. 5 (top)—A group of miscellaneous gages.

Fig. 6 (bottom)—Crankshaft for an airplane motor. An inexpensive salvaging medium for an important job-hard chromium plating of undersized bearing diameter.



2. Reduces wear to a minimum.
3. More uniform flow of compound.
4. Free extraction of molded part.
5. Higher finish of molded part eliminating buffing.
6. Cleaner finish on white and colored materials.

Heat Treating Essential

The Battelle Memorial Institute recently published a book for the Naval Aeronautical Specifications Bureau on fatigue failures of metals due to stresses and strains. Many failures in plating have been traced to these same stresses and strains existent in metals that have been stamped, cold worked or ground. Much grief can be eliminated by the proper drawing of these parts prior to plating, relieving conditions such as preferred orientations of crystalline structure. Degenerate pearlitic structures are also a cause of trouble resulting in the chromium plate being blamed for a cracked condition. In reality, a shifting of crystals in the base metal is responsible for a cracked electrodeposit.

The simple expedient of drawing before plating will eliminate this condition of stresses and strain. Because of an occlusion of hydrogen during the hard chromium plating operation, a heat treating operation consisting of two to three hours at 350° is necessary. By watching these heat treating angles closely, fatigue failures can be minimized.

Fig. 7—Spindles and shafts requiring plate on certain diameters are protected as illustrated. Everything but the actual section requiring plate is stopped-off. The small shaft has been plated on three diameters. Note cleanliness of shaft in general.

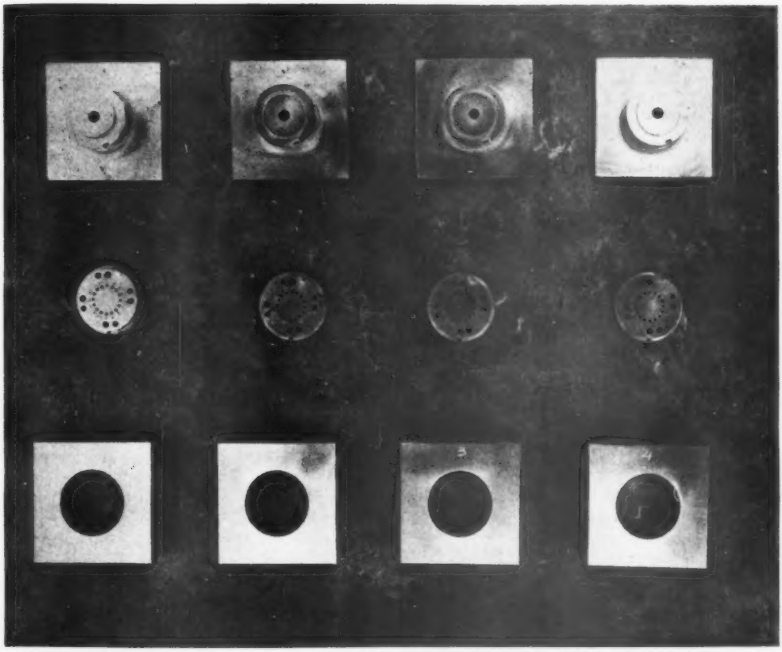


Fig. 8—View of some plated molds to be used in the plastics industry.
Photographs courtesy George E. Meyers, Inc.

Chrome Plating Limitations

When properly handled, the limitations of hard chromium plating are few. In this category, however, we must include cutting tools. We are approached daily to salvage drills, reamers, taps and cutters, requiring up to .020" of plate. The physical characteristics work directly against us in this one phase in that it is too hard and brittle to stand up against impacts on sharp edges.

The time to use chromium plating on these small tools is when they are new. Then a thickness of from .0001" to .0002" will increase wear considerably.

Conclusion

In summing up the field of the electrodeposition of hard chromium as an aid to the war effort, we find the following facts.

1. A great preservative for new tools and parts.
2. Invaluable as a salvage medium.
3. Physical characteristics amazing when grouped together, namely: hardness, corrosion resistance, low coefficient of friction, high resistance to heat, dense crystalline structure.
4. Has an adherence to base metal superior to that of any other electrodeposited metal.
5. Can be stopped off cleanly on areas requiring plate and not affecting rest of part.
6. When worn, plate can be stripped without affecting base metal and new coating applied.
7. Advocated by Metals Conservation Division of the War Production Board.

Modern Milling Fixture Design

The need for improved fixture designs has risen in direct proportion to the need for increased materials of war. This is the twelfth timely article in the current series.

by C. W. Hinman

Designing Engineer

CONTINUING the subject of building up a milling fixture by welding (See November Issue), Fig. 63 shows the method of welding a supporting leg under the rear end of a clamp. C-clamps are usually employed to hold small parts in position when welding, as illustrated in Fig. 67. Vises are also used for holding small parts. The work is removed after one seam is completed and before the other seams are welded.

Figure 64 shows how a fulcrum pin bearing is welded on the base plate of a milling fixture. The bearing is located and held in position with C-clamps. However, if the bearing must be positioned a considerable distance from the edges of the base, an angle is used as in Fig. 67.

Figure 65 illustrates the method of producing a T-slot by building up its parts and welding them on a block. The block is subsequently welded in its proper place on the fixture. Two locating blocks are used for sizing the T-slot and the parts are temporarily held for welding by using clamps. The sizing blocks are removed after welding the parts. This method for making a T-slot is many times quicker and cheaper than cutting it from a solid block or assembling the parts with screws and dowel pins.

In Fig. 66, a tube is symmetrically welded in position on one edge of a supporting plate preparatory to welding on the base of a milling fixture, as sketched in Fig. 67. The tube may be a bearing in a milling fixture or a guide for a sliding thrust-pin designed to hold work for milling.

The arrangement of angles and blocks for holding work in conjunction with C-clamps may require some ingenuity. Some diemakers use an elaborate temporary welding fixture when only a simple fixture is necessary. Often a thin plate (held down with light screws) across the top of the work is sufficient.

Threaded studs are frequently used to hold working members in milling fixtures. The studs may be fulcrum pins that pass through holes in clamping levers, or they may be stop pins for holding the work. In such cases the pins must be designed to resist considerable side thrust. The best method for inserting them in the fixture is sketched in Fig. 68. Two alternate methods are shown in the sketch but neither are con-

sidered satisfactory designs when the pin must resist side thrusts.

Cast Body Milling Fixtures

Comparing welded milling fixture bodies (built of cold rolled steel plates) with cast iron or semisteel fixtures, the latter require much more time to build. First, the designer must make a pattern sketch for the casting and send it to the patternmaker. Several days may be lost waiting for the wood pattern. Second, after the pattern has been sent to the foundry several additional days, or perhaps weeks, are lost waiting for the casting. Third, many hours may be consumed in the shop for machine finishing the casting; and further, the casting becomes weaker after finishing its surfaces. Cast fixture bodies cost probably five times more to produce than the welded article and they are much heavier in size and weight and usually are no more efficient in use. However, in many small town shops a foundry may be within easy reach, and arc welding service cannot be obtained, then castings must be used.

There are a number of precautions to observe when designing castings for milling fixture bases. Figures 69, 70 and 71 show three important examples. These precautions should be kept in mind when designing all types of ferrous castings. Figure 69 illustrates the right and wrong designs for U-bolt slots. The wrong design is one too often used and frequently results in cracked or broken slots. The right design provides sufficient width of metal and a corner "sweep" of arc that ensures maximum strength. Both internal and external sharp corners should be avoided in all types of ferrous castings. In nonferrous castings these precautions are not so important but they should still be considered.

Figure 70 shows how a square cornered wall in a casting may fracture. This trouble develops during cooling when the casting shrinks, especially if the walls are thin and too high in relation to thickness. The right design uses an ample radius of metal across the corner which compensates for shrinkage and provides plenty of strength.

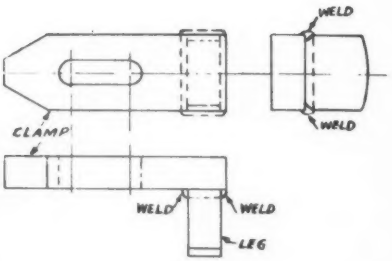


Fig. 63

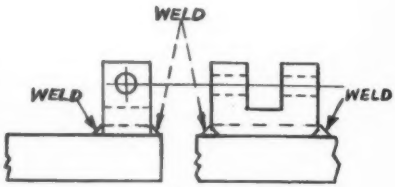


Fig. 64

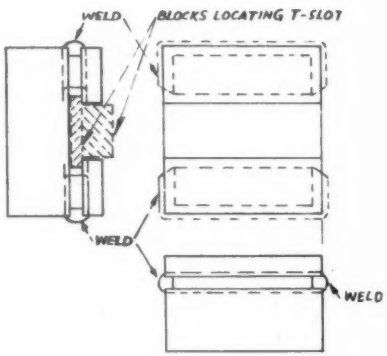
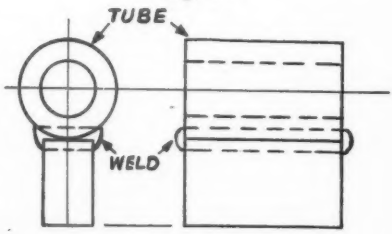
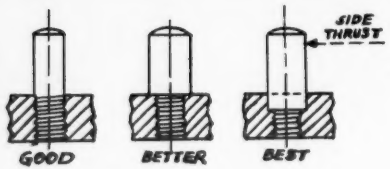


Fig. 65

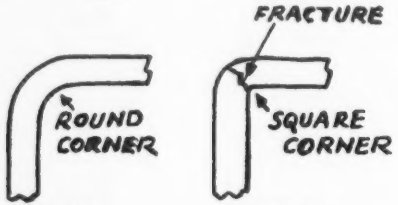
Fig. 66



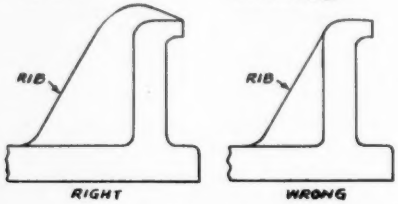


◀ Fig. 68

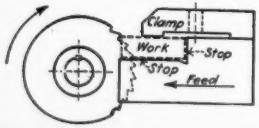
◀ Fig. 69



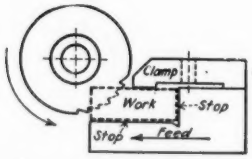
◀ Fig. 70



◀ Fig. 71



◀ Fig. 72



◀ Fig. 73

◀ Fig. 74

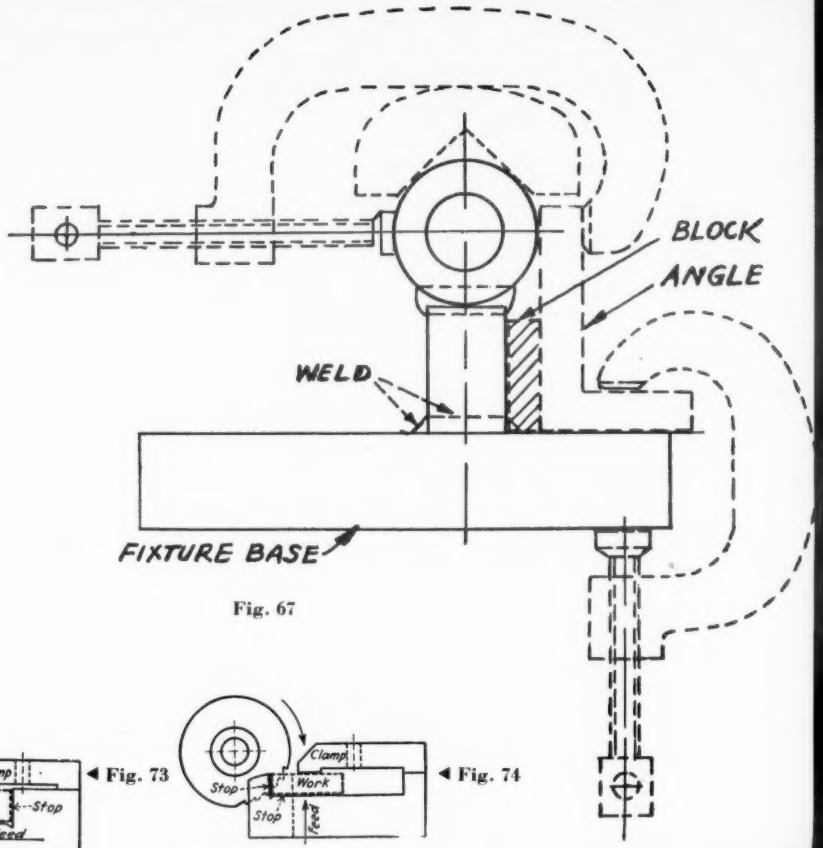


Fig. 67

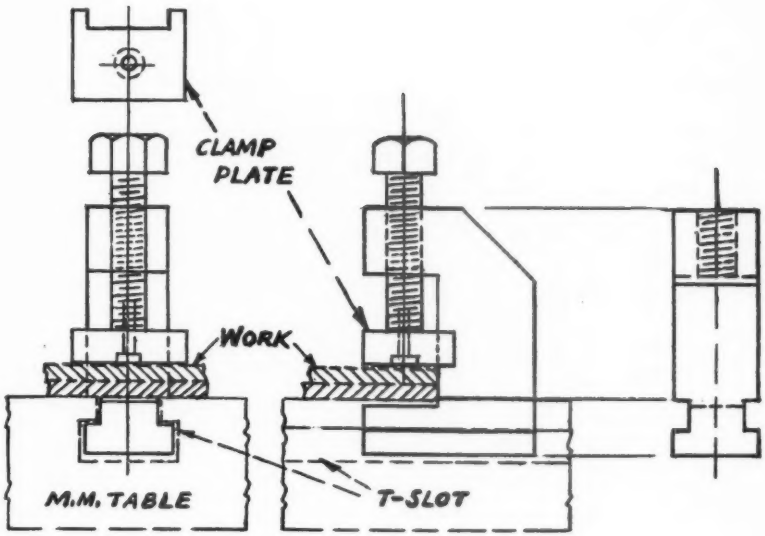


Fig. 75

Figure 71 illustrates a common error in design when using brace ribs behind a channel casting. The right rib design for this purpose should have a wider base. The rib, then, is carried up in a sweep across the top of the channel providing extra strength around the walls.

Designing Milling Fixtures

The simplest milling fixture for holding work is a pair of jaws secured in a milling vise. Vise jaws are cheap and efficient tools. They are easy to make and especially economical in the small shop. The next simplest milling fixture is a plate having positive stops arranged against the work, and keys or clamps for holding down the work.

Milling fixtures should be designed so that the revolutions of the cutting teeth are *against* a stop behind the work. The revolutions of the teeth should have a definite tendency to force the work piece against the fixture stops while the clamps hold it down. This prevents the teeth from "hooking" into the work while cutting—a condition which breaks slender teeth. The only exception to this rule is for "climb milling" in which the cutter teeth revolve in the same direction as the feed, but the teeth are comparatively heavy and the feed and cuts are light.

REPRINTS

"Typical Designs for Drilling Jigs and Fixtures," a series in six parts, has been reprinted by popular demand. This series has been written by C. W. Hinman, well-known engineer and author of "Pressworking of Metals" and "Practical Designs for Drilling & Milling Tools."

Copies may be secured by writing The TOOL & DIE Journal, 2460 Fairmount Blvd., Cleveland, O. Price, 25c per copy.

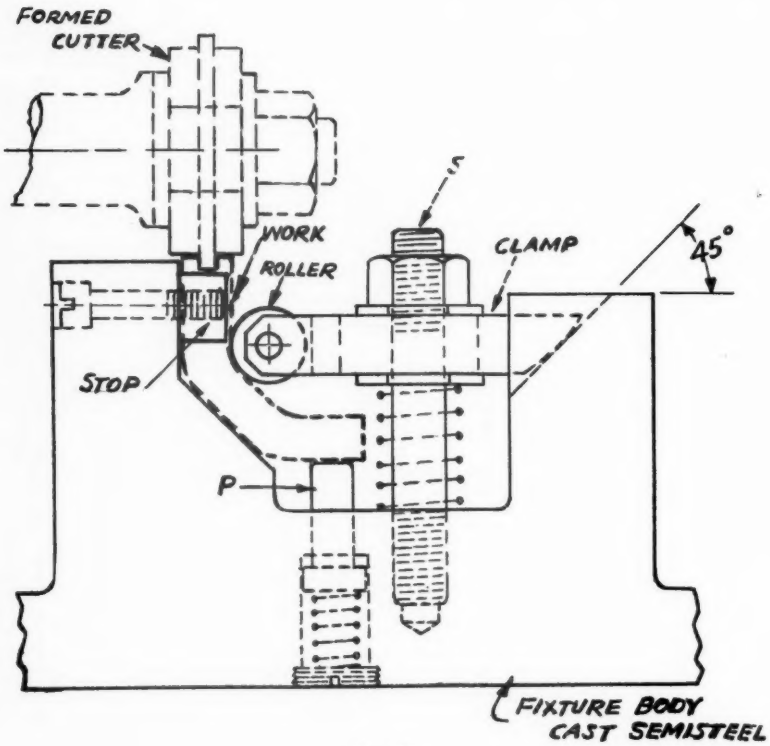


Fig. 76

Before designing a milling fixture or vise jaws, first determine by sketches the direction for feeding the work in relation to the revolutions of the cutter teeth. Next, provide positive stops for taking the thrust of the cut, and for a fixture, provide clamps for holding down the work. These principles are set forth in Figs. 72, 73, and 74. In each of these cases notice that the end stop lies against the work and opposite the cut, and that it extends up the full height or the entire thickness of the work piece.

An Efficient T-Slot Clamp

The body of the T-slot clamping head shown in Fig. 75 is of machinery steel and case hardened. The screw head and clamp plate are also case hardened. Many uses can be found for a quantity of such clamps around the toolroom or in production departments.

This fixture is used in holding work for milling, but it can also be used for holding work in any machine that has a work table provided with T-slots. These clamps can be cheaply made, and by their use a quantity of blanks can be quickly clamped together and machined in one setup.

Holding Odd Shapes of Work

Figure 76 shows a simple and effective principle for quickly clamping and rigidly holding certain types of oddshaped pieces for milling. This clamp can also be successfully incorporated in drilling jigs, tapping fixtures or on a planer bed.

(Continued on Page 100)

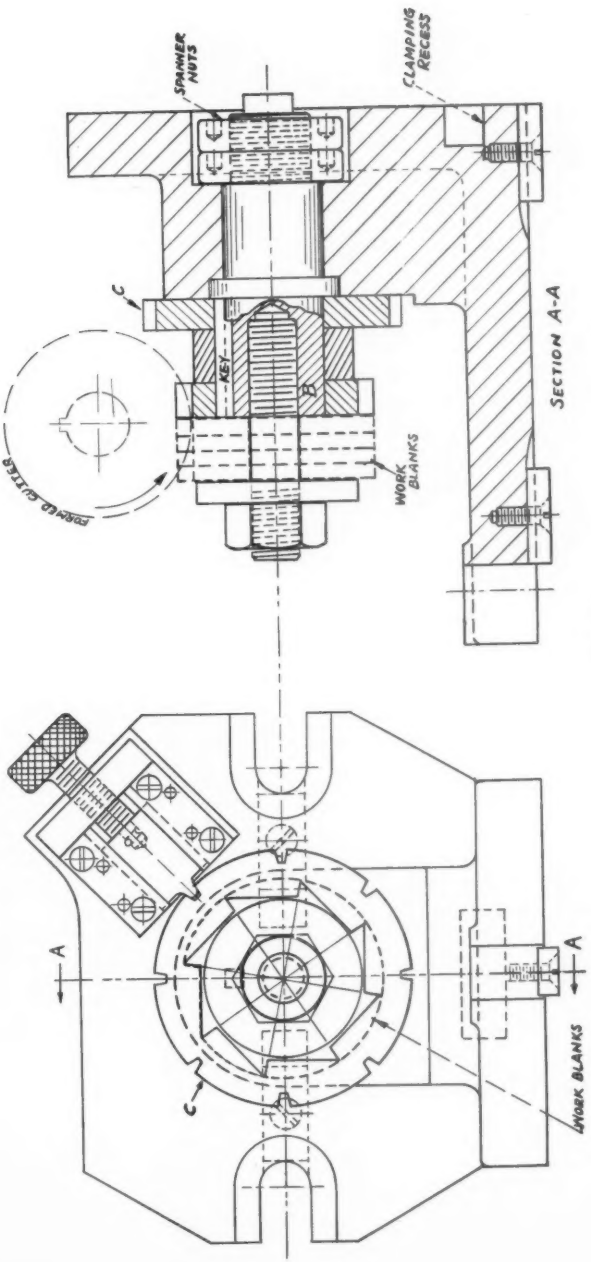

SPANNER NUTS
CLAMPING RECESS
C
KEY
B
WORK BLANKS
SECTION A-A
REMOVED CUTTER
A
A
C
WORK BLANKS

Fig. 77

From Zippers to Bomb Tail Fuses

The parts used in the manufacture of bomb tail fuses are ordinarily made on automatic screw machines. One of the country's three largest manufacturers of zippers, working with Army Ordnance officers, developed an unusual production method for the manufacture of bomb tail fuses which supplants the use of automatic screw machines and suggests a means whereby other manufacturers may overcome shortages of these machines.

BOMB tail fuses are today coming off a production line composed of 175 second-hand and reconditioned hollow spindle lathes, turret lathes, milling machines, drill presses, band saws, etc., which have been set up as single purpose machines.

These oddly assorted machines were redesigned and rebuilt to do specific work operations on each of the fourteen parts which go to make up a bomb tail fuse. Converting the engine lathes to single purpose production machines capable of working to tolerances as close as .001" and .002" called for two precision jobs. First, was the reconditioning of worn parts to guarantee close tolerances in operation. The second was the redesigning and building of special turret heads, cross slides, tools, jigs and fixtures.

Lathe heads were redesigned and rebuilt; shafts reground and new bushings installed; lathe beds scraped and levelled. Tail posts were removed and turret heads designed to do definite work operations substituted in their place.

Cam operated cross slides were made for certain operations. Belt drives were replaced with individual drives.

Special single purpose jigs were made for the drill presses and milling machines. For example, in drilling small holes in a plunger, a fixture was made which not only holds the plunger in a fixed position but, when released, makes it possible to load and unload in a single motion. To speed milling operations, jigs were made to hold four and five parts. For tapping operations special tapping heads were made for the drill presses.

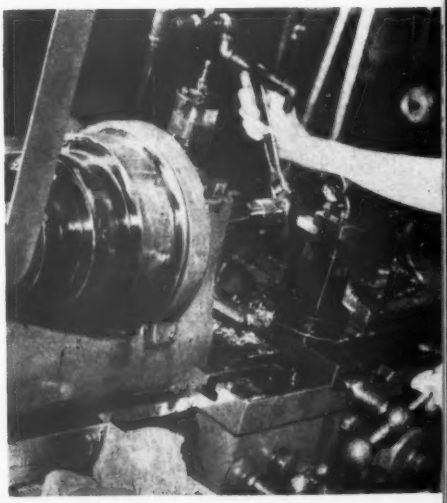
To speed up operations on the rebuilt lathes, automatic bar feeds were installed on all the machines. Machines were set up in the consecutive order of work operations on individual pieces and inclined channels conveyed parts from

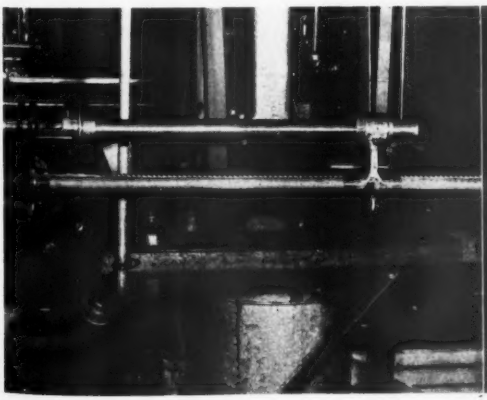
one machine or inspection table to the next work operation. Time saving short cuts were utilized to the fullest. Every expedient that would reduce the time involved in work setting, handling and machining was used. Quick change collets replaced adjustable chucks and lathes were tooled to perform the maximum number of operations without resetting.

One lathe with a hexagon turret in place of the former tail stock and a square turret on the cross slide performed eleven machining operations on the body of the fuses. The extra operation above the number of tool positions was gained by setting two tools in one prong of the hexagon head to machine internal and external surfaces simultaneously.

Credits: Editorial Material, War Production News
Photographs by Gruber

Top—Toolmaker examines work on lathe being rebuilt.
Middle—Girl sets work on quick-change collet.
Left Below—Automatic bar feed attachment added to rebuilt lathe.
Right Below—Machining part of bomb tail fuse on rebuilt hollow spindle engine lathe.





Procedures for Brazing High Speed Steel

Scarce strategic materials such as tungsten, molybdenum, chromium, vanadium, and cobalt have necessitated conservation of high speed steels. This article discusses two brazing methods for conserving these materials.

by B. S. Lement and W. B. Kennedy
Metallurgist and Production Superintendent
Watertown Arsenal

THE present emergency has focussed attention on the problem of conserving high speed steel because it contains relatively large percentages of strategic tungsten, molybdenum, chromium, vanadium, and cobalt (in special types). High speed steels containing 18% of tungsten are being replaced by molybdenum high speed steels in which the tungsten content has been substantially reduced.

Despite this important advance, much more remains to be done since the content of the other strategic elements is the same and there is a great demand for both tungsten and molybdenum for other uses besides high speed steel. One conservation method is to increase tool efficiency by devoting proper attention to such factors as tool design, heat treatment, grinding procedure and cutting conditions. However, there still remains the problem of waste due to the fact that only a small amount of a tool is actually used up in cutting. To minimize this condition, the possibility of making tools by joining high speed steel tips to low alloy steel shanks was investigated at Watertown Arsenal by the authors.

Success along these lines with carbide tipped tools suggested that brazing might also be applied to the tipping of tools with high speed steel. Brazing media for carbide tipped tools are copper, tobin bronze, and silver solder. The shanks are generally made of low alloy steels having carbon contents between .40 and .60%. A wide variety of steels may be used, but a silicon-manganese steel of the chisel steel type has been found to possess the best all around properties.

Carbide tips are usually copper brazed in a furnace having a suitable reducing atmosphere, although an oxy-hydrogen torch with excess hydrogen is occasionally used. Silver brazing of carbide tips is mainly accomplished by

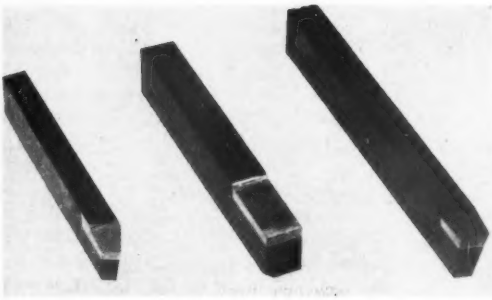


Fig. 1 (left)—Braze-hardened molybdenum high speed steel tipped tools.

Fig. 2 (below)—Assembly for copper brazing of high speed steel tip.

means of an oxy-acetylene torch.

Braze-Hardening

To apply copper brazing to the tipping of tools with high speed steel it is necessary that the brazing operations be carried out at a temperature that will permit satisfactory hardening of the tip. Molybdenum high speed steels are suitable since they have a hardening range of 2150° F to 2250° F or 170° F to 270° F above the melting point of copper. By soaking the tip in this temperature range, allowing the copper to set by cooling in air, and finally quenching in oil, the tip will be brazed to the shank and also be in the hardened condition. This method has been named Braze-Hardening.

Braze-hardening may be carried out in a commercial furnace designed for the copper brazing of carbide tips. At Watertown Arsenal an electric furnace, provided with a semi-circular muffle made of heat resisting alloy, is used. The furnace is designed to apply localized heat only to the portion of the tool to be brazed. A hydrogen atmosphere is maintained inside the muffle to prevent oxidation.

Braze-Hardening Procedure

The procedure found satisfactory for tipping lathe tools with molybdenum

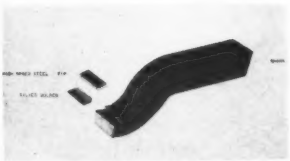
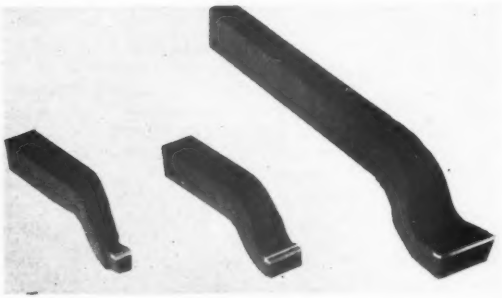


Fig. 3 (right)—Braze-tempered high speed steel tipped tools.

Fig. 4 (above)—Assembly for silver alloy brazing of high speed steel tips.



high speed steel involves several steps. The joining surfaces of the unhardened tip and shank are first cleaned by immersion in carbon tetrachloride. The end of the shank to be tipped is covered with a commercial powdered copper brazing flux and the tool is pushed partly into the muffle of the brazing furnace. When the flux has melted and spread over the surface, the shank is withdrawn from the muffle.

The tip and shank are fitted together with strips of copper in between and on top of the tip and additional flux is applied. The assembled tool is then moved partly into the muffle in order to preheat the tip. When the tip has attained a temperature of approximately 1500° F, the tipped end is moved into the high heat portion of the brazing furnace operating at 2225° F. In coming up to this temperature, the melting point of the copper (1980° F) is exceeded and brazing occurs during which the copper on top of the tip melts and actually flows in between the tip and shank.

After allowing the tip to soak for a sufficient time at 2225° F to insure satisfactory hardening, the tool is withdrawn from the muffle and the tip is pressed firmly in place either by tongs or in a press in order to squeeze out any excess copper or flux. When the copper sets, the tipped end is quenched in oil to below 200° F. The result of this procedure, which takes less than 20 minutes for each tool, is a tip in the hardened condition and brazed firmly to the shank. It is necessary to temper the tipped tool at 1050° F as is done with a hardened solid high speed steel tool, in order to develop secondary hardness.

Three molybdenum high speed steel tipped tools are shown in Fig. 1. The assembly used in copper brazing is illustrated in Fig. 2 for a tool 9" long, 1¼" high and ⅝" wide. A folded copper strip of .01" total thickness is placed on the tip and a single strip .002" in thickness is placed between the tip and shank. After braze-hardening and tempering at 1050° F for two hours, a hardness survey was made on this tool. The tip attained a uniform hardness of about Rockwell C 65 while hardening of the shank occurred for a distance of about 5" from the front of the tool.

Braze-Tempering

Silver brazing can also be used to make high speed steel tipped tools, but the low melting point of commercial silver solder (about 1200° F) prohibits using the same procedure as with copper brazing. However, by using previously hardened tips, it is possible to braze the tip and temper it simultaneously. Since the melting point of silver solder is higher than the usual tempering temperature of high speed steel, it is imperative that very short brazing times be employed to avoid over tempering and consequent softening.

Any high speed steel composition may be used as tips; however, special composition such as high-carbon, high-vanadium high speed steel and cobalt high speed steel are particularly suited to this method since they have greater resistance to softening on tempering than the ordinary high speed steels. This method has been named Braze-Tempering.

Braze-Tempering Procedure

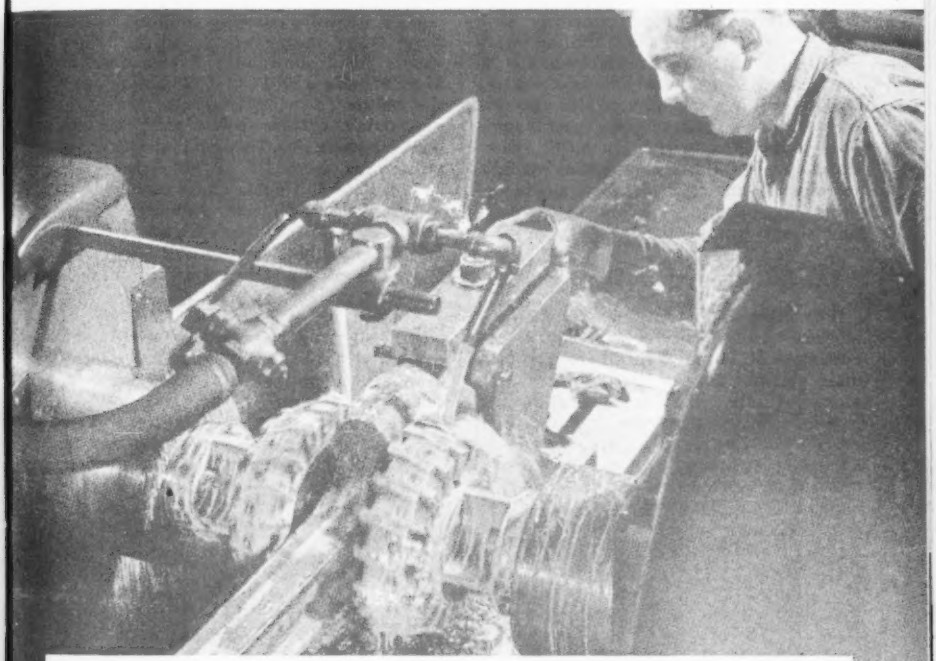
In braze-tempering, the joining surfaces of the shank and hardened high speed steel tip are thoroughly cleaned and covered with a commercial silver brazing flux made in paste form. The tip is fitted on the shank with an intervening strip of silver solder .003" in thickness. The assembled end of the tool is then heated by playing the flame of an oxy-acetylene torch along the bottom until the heat soaks through the shank and melts the silver solder.

Care must be taken to avoid over tempering of the tip by minimizing the time between melting and solidification of the silver solder. During this time the tip is pressed firmly in place. When the silver solder sets, the tipped end of the tool is quenched in oil for a few seconds to drop the temperature of the tip below 1000° F where effective tempering ceases. The tool is removed from the oil and allowed to cool in air in order that transformation of the retained austenite present in the hardened high

(Continued on Page 122)

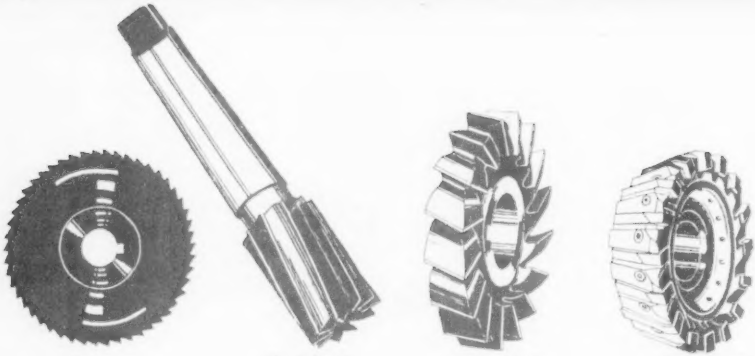
TRAINING *for Victory*

EDITORS: DON E. ROOT CHARLES H. HAYNES



MILLING TECHNIQUE

GRINDING Technique, the first of this series on Training for Victory, was an instant success. Commendation was received from both government and industry production officials. The unique subject treatment provides a refresher course for experienced operators, vital assistance to partially trained workers, and foundational data for trainees. Reprints of both "Grinding Technique" and "Milling Technique" are available.



Saw End Mill Side Mill Face Mill

MILLING is a process for machining metal to a specific shape or form with rotary cutters at relatively slow speeds. The majority of milling work can be accomplished on a lathe but parts are shaped more quickly and accurately with a milling machine. It is particularly valuable in producing interchangeable parts on a production basis. However, it is equally important for machining special cutting tools, dies, molds and precision specialties. Work of virtually any shape can be produced by milling.

Types of Cutters

The most important factor in milling efficiency is the correct selection of the cutting tool. In general there are four main groups: face or plain cutters; side or radial mills; angular cutters; formed cutters. Most cutters are produced from carbon and high speed steel correctly hardened, tempered and ground. Large mills frequently have a cast iron or machine steel body with inserted high speed steel or carbide teeth. Teeth are usually serrated to break chips faster and reduce friction. There are numerous adaptations of these basic designs that are used for specific milling operations. Plain or face mills are used to produce a flat surface parallel to the cutter's own axis. Usually plane milling cutters of ¾" have helical teeth—less than ¾" have straight teeth. They are used principally for cutting keyways, slots and similar work. The teeth should have a 6° or 7° clearance if the cutters are under 3" in diameter and 4° or 5° clearance for those over 4". Vibrations will result if the clearance is too great.

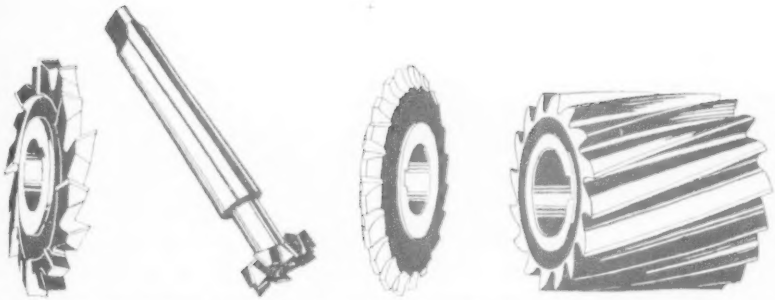
Side or radial mills are used to cut surfaces perpendicular to the axis of the cutter. These cutters have teeth both on the side and periphery and are principally used for straddle milling operations when mounted in pairs. They should be ground with a clearance of 2° to 4° with a .001" to .002" hollow near the center.

Angular cutters have teeth on an angle to the axis. The usual single angle mills vary from 40° to 80° either left or right hand. Double angle cutters have an angle on each side, standard angles being 40°, 43°, 45° or 48° on one side and 12° on the other. Tooth clearance should be ground the same as on face and side cutters.

Formed or "form" cutters have a curved or irregular outline with teeth ground radially and equidistantly. They are used to mill a form reversed from their own design.

These four groups of cutters have hundreds of variations and it would be impossible to describe here all of their designs and uses. There is, however, another type of cutter used extensively. All the cutters previously mentioned are mounted on an arbor running from the machine spindle to the arbor support. End mills, however, are held by the spindle and have teeth in the end of the cutter with either a left or right hand spiral. They are used in both vertical and horizontal machines and are especially valuable in die, jig and fixture work.

Gang mills (Fig. 1) are a combination of cutters mounted on an arbor and are used to produce formed parts. War production has greatly stimulated the need for milling inasmuch as gun, tank and plane parts require a considerable number of shaping operations. The use of inserted tooth cutters has also been



Stagger Tooth Cutter **T-Slot Cutter** **Form Cutter** **Slab Mill**

increased. This has resulted from the need to conserve tool steel and the increased acceptance of carbide materials.

Cutter Design

In order to analyze cutter design and the influence it has on performance, each of the many variable components, including rake angle, clearance angle, helix angle, tooth form and tooth spacing, must be considered separately. However, it is the coordinated action of these variable components that ultimately determines the productivity of the cutter.

Rake Angle

The rake angle of a milling cutter is defined as the angle formed by the tooth face and a radial line drawn from the center of rotation to the cutting edge. Figure 2 illustrates the rake angle.

The efficiency of metal removal increases with an increase in the rake angle. However, this statement must be modified because of the varying influence which rake angle exerts on materials that vary in nature. An increase in rake angle when milling a brittle material, such as cast iron, reveals little increase in efficiency of metal removal. However,

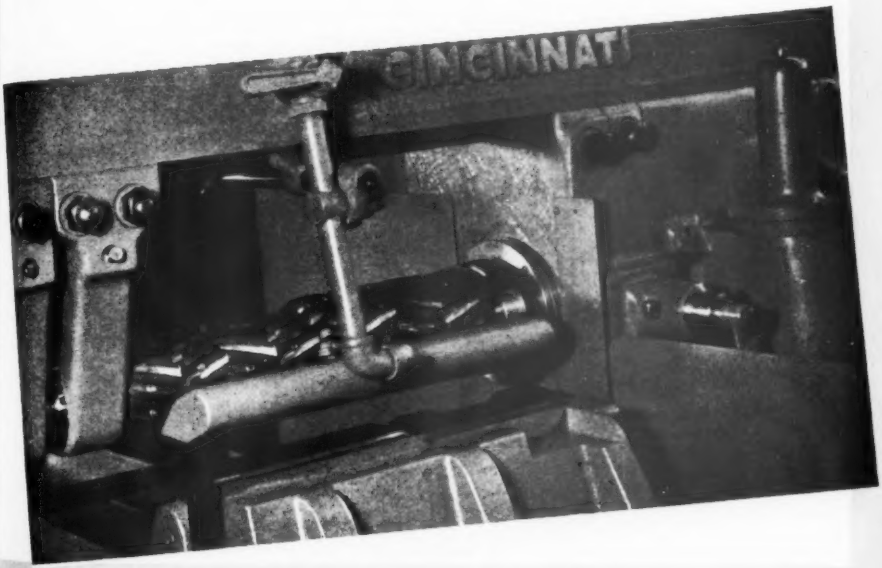


Fig. 1 — Typical illustration of gang milling.

ductile materials, such as soft steel, bronze and aluminum, may be milled with a decided increase in efficiency as the rake angle increases. The limit to which rake angle may be increased is naturally limited by the strength which must be maintained in the tooth. There are some cases, though, where a large rake angle is not desirable. Included in this category is work which has a thin or weak section or work which does not permit adequate clamping. In these cases there is a tendency for the cutter to dig in and raise the work out of the fixture, so a small or even a slightly

Fig. 2 — Diagram showing rake angle.

negative rake angle is sometimes used.

In actual practice, rake angles from 10° to 15° are commonly used, with a few specific applications being as high as 35°. Rake angle recommendations for milling various commonly used materials appear in Table 1.

Clearance Angle

The clearance angle or relief of a plain milling cutter may be defined as the angle formed by the "land" back of the cutting edge and a line drawn tangent to the circumference of the cutter at the cutting edge, as shown in Fig. 3.

The clearance angle of the side cutting edges of the teeth in face mills, shell end mills, side milling cutters, or any other cutter in which the direction of motion of this edge is always in a plane parallel to the finished surface of the work, is formed by the land and a line drawn from the cutting edge in a plane at right angles to the cutter axis, as shown in Fig. 4. This clearance usually varies between 1° and 3° and occasionally larger but not greater than 5°. This applies to the sides of the teeth only.

The sole function of clearance or relief of the flank surface is to prevent undue interference between it and the surface of the work. Considering clearance in relation to power consumption, the angle need only be great enough to prevent the flank from rubbing on the surface of the work; but at the other

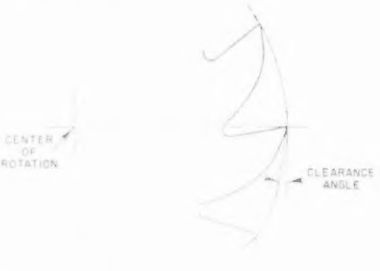


Fig. 3—Diagram showing clearance angle.

extreme, the angle should not be so great as to cause chatter or speedy dulling of the cutting edge.

The minimum permissible clearance angle is affected by the width of the flank (land) back of the cutting edge. This should be kept to a small value, $\frac{1}{32}$" to $\frac{1}{16}$", in order that the true clearance at the cutting edge may be as small as possible. As shown in Fig. 5, a secondary clearance angle behind this land is usually provided to prevent the heel of the tooth from dragging and to reduce the amount of material that must be removed when regrinding the cutter.

The clearance angles for the peripheral edges of the cutter, when milling the more commonly used materials, are given in Table 1 and should be used as a starting point. If unsatisfactory performance results from following these recommendations, it is possible that a little more or little less clearance angle may im-

Fig. 4 — Clearance angle of side cutting edge.

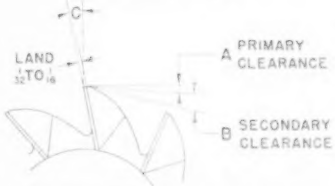


Fig. 5 — Clearance angle of peripheral cutting edge.

prove the performance. In any case, the determination of the exact clearance angles which will produce the best finish and the greatest number of pieces per sharpening is a "cut and try" proposition. After you have once found the best clearance angles for a particular job, record them so that you may be able to duplicate the results.

Helix Angle

Helix angle is defined as the angle the cutting edge makes with the axis of the cutter, as shown in Fig. 6. Cutters with a helix angle up to 45° are commonly termed spiral mills, while those above 45° are termed helical mills.

The main function of helix angle is to increase the smoothness of cutting and to help eliminate chatter. A spiral or helical milling cutter engages the work first at one corner and then progressively across the width of the cut, eliminating the shock which even a moderately wide straight tooth cutter produces as the entire cutting edge engages the work.

Tooth Form

From a theoretical viewpoint, the parabolic tooth form will give uniform strength throughout the height of the tooth. This ideal tooth would be of maximum strength for a given cross sectional area and would contain no excess metal. However, practical modifications must be applied to the theoretical design, so that the resultant tooth will appear in section as in Fig. 7. The tooth form is not limited to the parabolic structure, for methods of manufacture may strongly influence the cutter design.

MILLING WITH HIGH SPEED STEEL

TABLE 1

Approximate Clearance Angles for High Speed Steel Milling Cutters

Work Material	Primary Clearance Angle—A	Secondary Clearance Angle—B	Rake Angle—C
Alloy Steel.....	2—3°	6—10°	10—15°
Mild Steel.....	3—4°	6—10°	10—15°
Cast Iron.....	3—4°	6—10°	10°
Brass	3—4°	6—10°	10—20°
Bronze (Hard).....	2—4°	6—10°	10—15°
Aluminum	6—10°	6—10°	10—35°

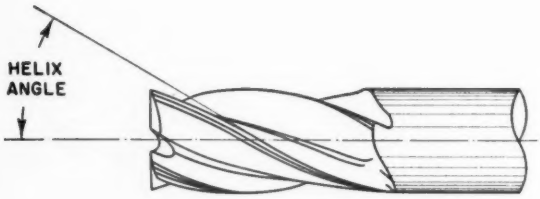


Fig. 6—Diagram showing helix angle.

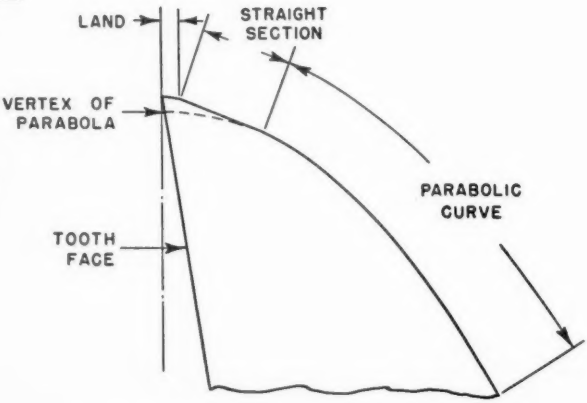


Fig. 7—Tooth profile of a plain milling cutter.

Form cutters differ in design from plain milling cutters due to the methods involved in manufacture and sharpening. The relief or clearance of a form cutter is produced simultaneously with the form. The cutter is sharpened by grinding the face of the tooth, so that the form and clearance of the teeth are maintained throughout the life of the cutter.

Tooth Spacing

No rules exist for the exact number of teeth or the amount of chip space between the teeth required for milling cutters. It is known, though, that less power is required to remove a given amount of metal using a cutter with a few teeth, rather than a cutter with a greater number of teeth. This is possible because of the thicker chips which are produced by the cutter with fewer teeth. But the number of teeth cannot be reduced indiscriminately without due consideration of the feed and speed at which the cutter will operate. Generally speaking, the "coarse tooth" type of cutter offered by manufacturers has been found satisfactory for most purposes.

An exception to the above statement must be made for cutters which are to be used for milling the lighter metals, such as magnesium, aluminum, etc. Because of the higher speeds and greater feeds which are possible, adequate chip space must be provided to handle the increased volume of chips.

Cutter Sharpening

Cutter sharpening in itself ranks high as a factor which directly influences tool life and quality of work produced. The

cutter must not only be correctly sharpened but it must be sharpened before it has become too dull.

Correct sharpening procedure naturally centers around the rake and clearance angles of the cutter teeth, which should conform to the principles outlined in "Cutter Design". Aside from this, there are several other important considerations upon which tool life and quality of finish depend. A grinding wheel of the proper grade and grain size must be used. Close examination of a cutter which has been ground using too coarse a grain will reveal imperfections which can result only in a poor finish on the work and premature dulling of the cutter. The high points on the cutting edge of a roughly ground cutter soon break down, leaving no clearance at these points, a condition which then quickly becomes general along the entire cutting edge. Of late, finely finished cutting edges have been found to increase the life of the cutter between grinds to such an extent that lapping or honing has proven profitable in some cases.

Most cutters are sharpened without using a coolant because of the inconvenience and also, when coolant is applied, the heat developed by the grinding wheel at the cutting edge of the cutter is taken away so rapidly that small cracks may develop at the extreme cutting edge. Generally a soft grade of grinding wheel is used. This will prevent localized heating or burning of the cutter, which would tend to soften it at the cutting edges.

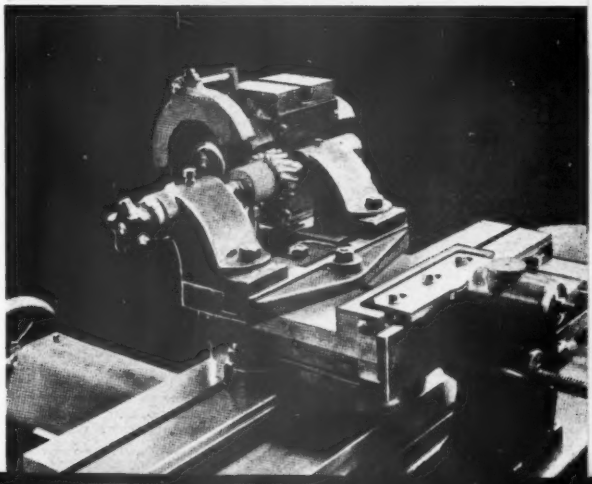
Very good results can be expected from a cutter which has been ground with a soft coarse wheel and then finish ground with a slightly harder fine grit wheel. As an added touch when a fine work finish is desired, hand stone the face and primary clearance of the teeth. Any cutter sharpened in this manner will present an even cutting edge, will be free from burning or overheating and will have all the teeth of uniform height. Although this method may require more time than ordinary grinding methods, remember that the number of pieces milled per grind and the number of times the cutter may be reground determine the effectiveness of the method of sharpening.

Any cutter may be pushed beyond the point of dullness at which regrinding would be most economical. However, to continue using a cutter after it has been dulled to this point will cause excessive wear and overheating or even breakage due to the high pressure which is built up at the dull edge. Excessive wear alone will require considerable removal of material from the cutting edge. Add to this the removal of extra material which has been softened by overheating and it will be realized that it pays big dividends to sharpen cutters more often.

Cutter Holding Devices

Arbors, adaptors and collets are standard equipment for holding cutters on the milling machine. The standard self releasing taper for milling machine spindles is 3½" per foot. These arbors are inserted in the milling machine spindle and are supported by an arbor support or milling machine frame. The milling cutters fit on to the arbor and are driven by keys and held end wise by a nut with suitable collars, washers or spacers to effect perfect positioning.

Fig. 8 — Sharpening the periphery of form milling cutters by use of special attachment.



For precision adjustment of gang cutters and to compensate for dimensional changes caused by sharpening, sets of collars in graduated thicknesses of thousandths of an inch are available as well as micrometer screw collars made adjustable to any size within its limits. There are various styles of milling machine arbors depending upon the size of the work being machined and the depth of cut required. Two hardened and ground sleeves serve as bearings in the arbor support which is hung on the over arm providing rigidity to the arbor and cutter. Standard spring collets are used for shell-mill work and in the case of end mills they are inserted directly into the spindle.

Fixtures

The proper method for holding the work piece is determined by the size of the work, its shape and the nature of the milling operation. Another deciding factor is the quantity of parts to be duplicated. In general there are three methods of holding work. The piece may be fastened directly to the work table, it may be held in a plane or universal angle device or in the case of rapid production special fixtures are used. The majority of milling operations require the latter since it is the most important factor in producing interchangeable parts. When the work is large and of a singular nature it is usually fastened directly to the work table, as in the case of milling special jigs, fixtures, dies and molds. Smaller parts of standard shape—square, round, hexagonal, etc.—are usually held in a standard milling machine device. There are numerous styles of these attachments available, many of which are adjustable to varying angles. They are operated both mechanically and hydraulically. Special fixtures are used when a quantity of similar parts are to be machined. In the case of small parts several pieces can be held in the fixture and milled at the same time. A series of articles on "Modern Milling Fixture Design" is currently appearing in The TOOL & DIE Journal. A large number of suggested locking and clamping devices are illustrated and discussed.

Indexing

Indexing is a method for rotating the work piece on its axis to an exact indicated amount. A dividing head and index plate is an essential attachment when indexing is necessary such as required in cutting gears, flutes and similar serrations of equidistant nature. The index tables are set to a previously determined setting to provide the proper spacing. Indexing can be either plane or universal. In plane indexing the indexing plate has three circles of holes —24, 30, and 26—and will index any number that divides evenly into any one of these. Universal indexing provides spacing up to as high as 400 and in some cases special index plates can be used when necessary. Many standard milling machines have indexing devices built into the machine and any indexing up to 200 is shown on the indexing plate.

Milling Operations

There are two methods for feeding work against the cutting teeth. The drawings shown in Fig. 10 diagrammatically illustrate conventional and climb milling. Both of these methods refer to the direction the work is fed in relation to the direction in which the cutting teeth revolve. In climb milling, the work is fed in the same direction that the cutting teeth revolve while in conventional milling this condition is reversed and the work is fed against the direction of the revolving teeth. Climb milling is a method of comparatively recent introduction.

The success of climb milling operations depends largely upon using a milling machine of very rigid construction and the slide-ways under the table should have extra long surfaces for positive bearings. Tables fed hydraulically are best suited for this operation.

Climb milling is most effective for producing clean-cut sharp serrations but the cutter must be provided with teeth of a shape best suited to this operation. The teeth should be of spiral types as angular sharp pointed slender teeth would immediately dig into the work and break at first contact. Slender pointed teeth, however, stand up well in the conventional types of milling if the work feed between the tooth contacts is not too great.

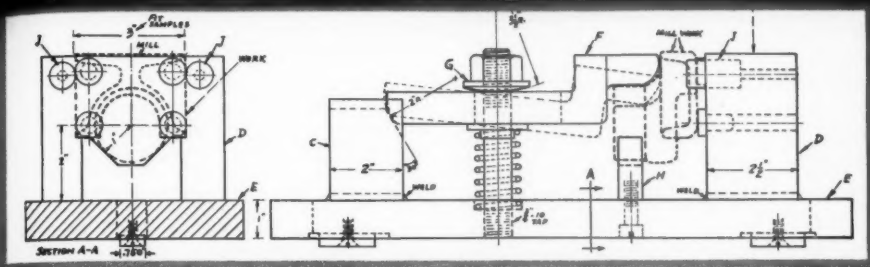


Fig. 9 — An assembly fixture used on a milling machine to clamp the work simultaneously in two different directions.

Machine Types

There is a large variety of milling machine styles and sizes. There are several methods for classifying; however, according to design the specific types are:

1. Column and knee type
   - (a) Hand
   - (b) Plain
   - (c) Universal
2. Vertical milling machine
   - (a) Reciprocating table
   - (b) Rotating table
3. Planer milling machine
4. Fixed-bed type
   - (a) Simplex
   - (b) Duplex
   - (c) Triplex
5. Special types
   - (a) Drum
   - (b) Thread
   - (c) Cam
   - (d) Offset
   - (e) Duplicator or profiling
   - (f) Pantograph

Hand and plain milling machines are used principally in small production work such as cutting grooves, keyways and slotting of small parts. The spindle is positioned horizontally and the work is fed to the rotating cutter either by hand or in the case of the plain milling machine by a power feeding mechanism which controls the table movement.

The universal milling machines are the most versatile of all types and may be used either for production or tool room work. It is particularly applicable to the latter since the work table is provided with movement in four directions instead of three. This permits cutting of spirals as are necessary on drills, mill cutters and cams. The majority of universal millers are available with the dividing head equipment, vertical milling attachment, rotary table attachment and standard holding fixtures—all of which add to its value as a tool room and die shop machine. Aside from performing milling operations these machines may

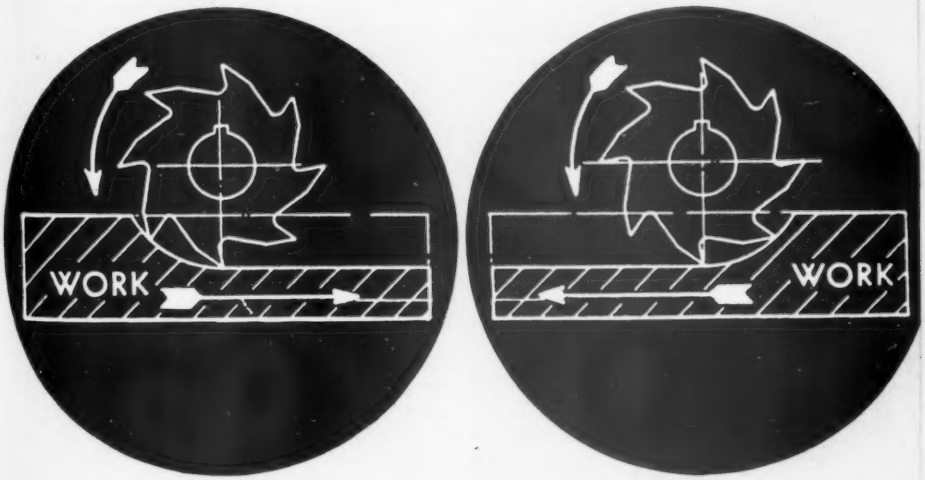
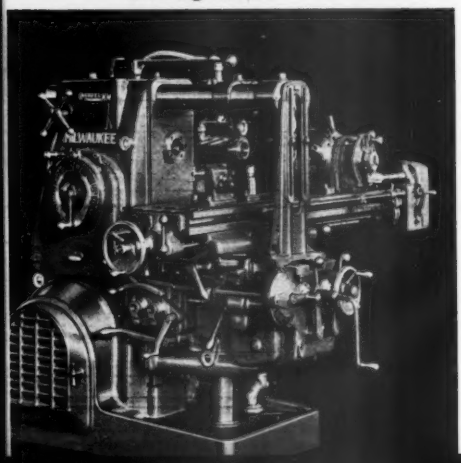


Fig. 10 — Two methods for making milling cutters. The one on the left is "climb milling" while on the right conventional milling is shown.

Fig. 11 — Simplex bed type machine.

Fig. 12 — Vertical milling machine in operation.

Fig. 13 — Universal milling machine with dividing head.



take the place of a shaper or drill press.

Vertical milling machines have a spindle vertical to the work table and for the most part use cutters of the end mill type. Drilling, boring and reaming are possible and the machine is particularly useful for accurately spacing holes, taking facing cuts and doing step milling as is necessary in die and mold work.

The planer type of milling machine has a table having only longitudinal movement. The slow table feed and the rotating cutter are the only features that distinguish it from a planer. This is a sturdy type of machine especially used for heavy duty milling operations.

Fixed-bed types of millers are production machines having one, two or three arbors in operation at the same time. With an accurate fixture a large number of parts can be precision milled.

For the most part other types of milling machines are classed as special millers. They are designed to perform specific milling operations. They conserve considerable time and expense in milling of standard parts as are needed in the automobile, aircraft and now the many war production industries.

The Action of Cutting Fluids

Cutting fluids, which are generally emulsions of soluble oil and water, are widely used as a means of protecting the cutter and improving the quality of finish of the work. There are three functions of the cutting fluid—cooling, reduction of friction and flushing of chips. While these functions are effected by the use of a single cutting fluid, the action of each must be considered as separate from the others.

Cooling

Quite naturally, a large amount of heat is generated in metal cutting, particularly when cutting strong, ductile materials such as steel. It follows that a means must be provided for conducting away this heat as it is generated because heating of the tool point causes a reduction in its resistance to abrasion, hastening dullness or wear. The quality of finish of the work is adversely affected as the temperature at the tool point increases due to the forming of a larger built-up edge. Aside from tool life and finish, an ample supply of coolant effectively maintains a comparatively low temperature of the work piece. This is necessary when the limits of accuracy

are such that expansion or deformation of the work piece due to heat while cutting cannot be tolerated. The delivery nozzle should be designed to supply coolant to the entire cutting area. But it must be remembered that when supplying coolant in large quantities and at a fairly high velocity, adequate splash guards must be provided; otherwise the operator may reduce the flow of coolant to prevent it from soaking his clothing.

For efficient cooling, the cutting fluid should have a high coefficient of specific heat. The ideal fluid is one that not only possesses this capacity for absorbing heat but also has the qualities which tend to reduce friction between the tool and the chips. Naturally, some fluids are better than others but no generalized recommendations can be made which will not meet with disagreement from some source. Conditions vary to such an extent that experimentation must determine the fluid that is best suited for specific materials or jobs. Intelligent counsel on cutting fluids is offered by many of the leading oil companies, which will help in making a selection.

Reduction of Friction

This function of the cutting fluid, as the paragraph heading implies, is the reduction of friction between the chip and tool face.

Due to the high friction and aided by high temperature and pressure, a built-up edge is formed on the tool, especially when milling strong ductile materials. As this built-up edge increases in size it becomes more and more unstable until failure occurs and fragments of the built-up edge escape both with chip and work piece, as in Fig. 14. This intermittent building up and breaking down of the built-up edge occurs at an extremely rapid rate, thus the surface of the work piece is covered with a multitude of fragments of built-up edge. It is these fragments which cause the roughness of a milled surface.

Therefore, in order to be efficient, the cutting fluid must effectively reduce adhesion between the flowing chip and tool face, preventing or materially reducing the formation of a built-up edge.

Flushing of Chips

The cutting fluid should be supplied in sufficient quantity to flush the chips away from the cutter and work, thus reducing the possibility of marring the finished surfaces, for chips that are allowed to remain in the path of the cutter are carried into the cut again.

Cutting Speeds and Feeds

Production cutting speed, feed and depth of cut vary with the different types of work and equipment. In tool room operations where heavy production type machines are not used and where holding devices are not permanent, high production speeds and feeds cannot be used. The values set up here can only be used as a guide and must be modified as experience indicates. It is almost

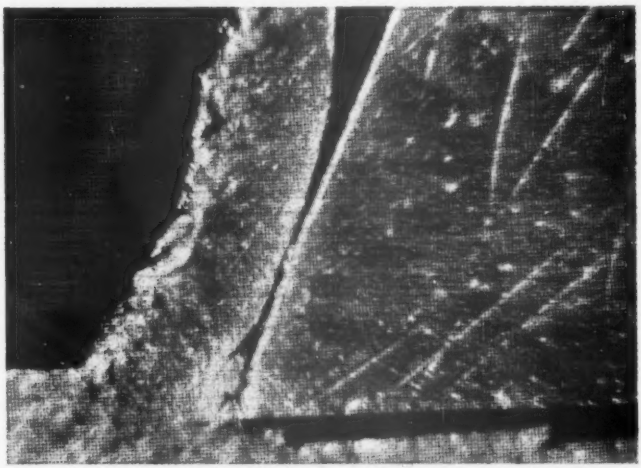


Fig. 14 — Photomicrograph showing formation of built-up edge and fragments which have passed off with the work.

TO OBTAIN THE R.P.M. OF A CUTTER AT A DESIRED SPEED (Feet per Minute)

RULE: Divide the feet per minute (F.P.M.) by the circumference of the cutter.
For a 5" cutter, 10 H.S. blades, to run at 80 F.P.M. the formula would be:

$$\text{F.P.M.} \div \frac{\text{Dia. of Cutter} \times \pi}{12} = \text{R.P.M.}$$

$$\text{or } 80 \div \frac{5 \times 3.1416}{12} = 61.1 \text{ R.P.M.}$$

EXAMPLE:

3.1416
5 In. Dia.
15.7080 Inches

1.31 Feet
12) 15.71

61. R.P.M.
1.31) 80.00 F.P.M.
786
140
131

TO OBTAIN SPEED OF CUTTER IN FEET PER MINUTE (F.P.M.)

RULE: The diameter of cutter (inches) multiplied by π, multiplied by revolutions per minute, divided by 12.

$$\frac{D \times \pi \times \text{R.P.M.}}{12} = \text{F.P.M.}$$

Example:

3.1416
5 In. Dia.
15.7080 In. Circumference
61 R.P.M.
157080
942480
12) 958.188 (80 F.P.M.

TO OBTAIN FEED PER TOOTH PER REVOLUTION (F.T.R.)

RULE: The feed per tooth per revolution equals feed per minute in inches, divided by the number of teeth in the cutter, multiplied by the number of revolutions per minute.
F ÷ (T x R.P.M.) = F.T.R.

EXAMPLE:

61 R.P.M.
10 Teeth
610 T.P.M.

.009 F.T.R.
610) 5.500 In. Feed
5490
10

TO OBTAIN FEED PER MINUTE (F.)

RULE: The feed per minute equals the feed per tooth per revolution multiplied by the number of teeth in cutter, multiplied by the number of revolutions per minute.
F.T.R. x T x R.P.M. = Feed

EXAMPLE:

.009 F.T.R.
10 T. in Cutter
.090
61 R.P.M.
5.49 Feed

TO FIND	HAVING	RULE	FORMULA
Speed of Cutter in Feet per Minute (F.P.M.)	Diameter of Cutter and Revolutions per Minute	Diameter of Cutter (In.) Multiplied by 3.1416, Multiplied by Revolutions per Minute, Divided by 12	$\frac{D \times \pi \times \text{R.P.M.}}{12} = \text{F.P.M.}$
Revolutions per Minute (R.P.M.)	Feet per Minute and Diameter of Cutter	Feet per Minute, Divided by Circumference of Cutter in Feet (Diameter x 3.1416 ÷ 12)	$\frac{\text{F.P.M.} \div D \times \pi}{12} = \text{R.P.M.}$
Feet per Revolution (F.R.)	Feet per Minute and Revolutions per Minute	Feed per Minute, Divided by Revolutions per Minute	F ÷ R.P.M. = F.R.
Feed per Tooth per Revolution (F.T.R.)	Feed per Minute and Number of Teeth in Cutter	Feed per Minute (In.), Divided by Number of Teeth per Minute (Number of Teeth in Cutter x Revolutions per Minute)	F. ÷ (T. x R.P.M.) = F.T.R.
Feed per Minute (F.)	Feed per Tooth per Revolution, Number of Teeth in Cutter, and Revolutions per Minute	Feed per Tooth per Revolutions Multiplied by Number of Teeth in Cutter, Multiplied by Revolutions per Minute	F.T.R.xT.xR.P.M.=F.
Feed per Minute (F.)	Feed per Revolutions and Revolutions per Minute	Feed per Revolution Multiplied by Revolutions per Minute	F.R. x R.P.M. = F
Number of Teeth per Minute (T.M.)	Number of Teeth in Cutter and Revolutions per Minute	Number of Teeth in Cutter Multiplied by Revolutions per Minute	T. x R.P.M. = T.M.

R.P.M. = Revolutions per Minute
T. = Teeth in Cutter
D. = Diameter of Cutter
π = 3.1416 (Pi)
T.M. = Teeth per Minute
F. = Feed per Minute
F.R. = Feed per Revolution
F.T.R. = Feed per Tooth per Revolution
F.P.M. = Speed of Cutter in Feet per Minute

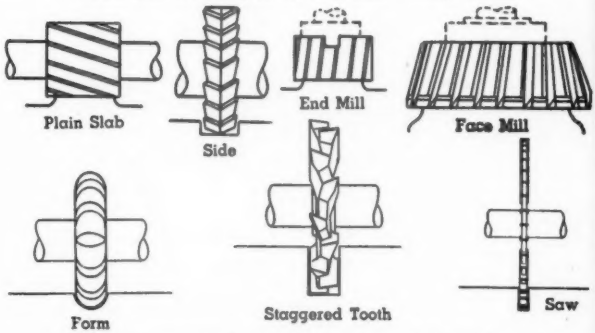
Table 2

invariably recommended that cutting speeds should be as high as possible commensurate with the life of the tool between grinds. A high cutting speed and light feed are necessary if a smooth finish is required. Depending upon the rigidity of the machine fixtures, cutters and desired finish the thickest possible chip per tooth should be taken. The cutter speed should be increased to the point where frequent cutter sharpening reduces ultimate production.

The feed of the work table is most important because it governs the machine output. When the speed of the cutter is increased the feed should also increase. A combination of speed and feed should be used to give maximum metal removal per cutter grind and still provide the required finish. Table 2 gives several rules for determining the correct speed and feed. Table 3 suggests a recommended chip load for conventional milling operations in cast iron, steel, brass and aluminum. Table 4 will aid the operator in determining the proper speed to use.

Table 3

Feed per Tooth per Revolution = Chip Load



Recommended Chip Load Tables

Type of Cutter	In Cast Iron	In Steel	In Brass Bronze Aluminum
Face Mill, H. S.	.020 to .025	Less 40%	Plus 50%
Slab Mill, H. S.	.010 to .015	Less 40%	Plus 50%
Slotting Cutter, H. S.	.006 to .012	Less 40%	Plus 50%
Form Mill, H. S.	.004 to .006	Less 40%	Plus 50%
End Mill, H. S.	.002 to .010	Less 40%	Plus 50%
Saw, H. S.	.001 to .003	Less 40%	Plus 50%
Cemented Carbide Face Mill	.008 to .012	.004 to .008	.010 to .016

In general, select the proper SPEED for work material and cutter; and then determine the feed, within the above limits, according to the cut and the power available or the finish required.

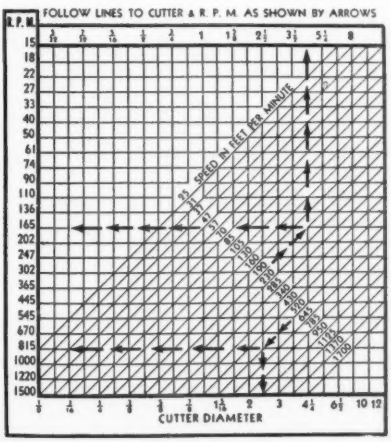
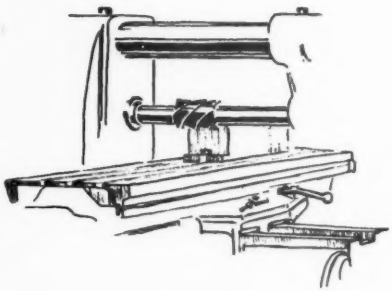


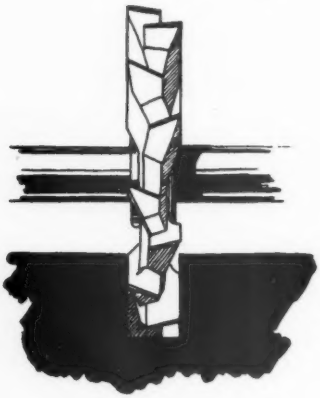
Table 4

Material To Be Milled	MATERIAL IN CUTTER					
	Carbon Tool Steel	High Speed Steel	Super HiSpeed Steel	Stellite	Tantalum Carbide	Tungsten Carbide
	CUTTER SPEED IN FEET PER MINUTE					
Aluminum	250–500	500–1000		800–1500		1000–2000
Brass Soft	40–80	70–175		150–250		350–600
Bronze Hard	30–60	65–130		100–160		200–425
Bronze Very Hard		30–50	50–70			125–200
Cast Iron Soft	30–40	50–80	60–115	90–130		250–325
Cast Iron Hard		30–50	40–70	60–90		150–200
Cast Iron Chilled			30–50	40–60		100–200
Malleable Iron	35–50	70–100	80–125	115–150		250–370
Steel Soft	30–45	60–90	70–100		150–250	
Steel Medium	30–40	50–80	60–90		125–200	
Steel Hard		30–50	40–70		100–150	



Right and Wrong Milling Practice

War production has placed unusual demands on man power and availability of machine tools. It is especially important now to get the most from every machine. The following suggestions are fundamental rules that each operator should follow in setting up, operating and maintaining his milling machine. The selection, use and care of cutters is equally important.



RIGHT

Clean the milling machine thoroughly after each setup and begin every job with a clean machine.

WRONG

Do not begin a setup with a dirty machine littered with chips and tools from a previous operation.

RIGHT

A staggered tooth cutter should be used for the milling of deep slots and grooves. It lessens vibration and results in better workmanship.

WRONG

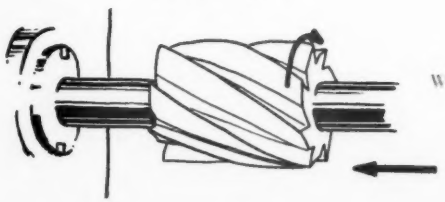
A straight tooth cutter should not be used for the milling of deep grooves. Vibration and chatter can hardly be avoided with this setup.

RIGHT

A coarse tooth cutter produces better work and helps to eliminate chatter.

WRONG

Use of fine tooth cutters is questionable milling practice.



RIGHT

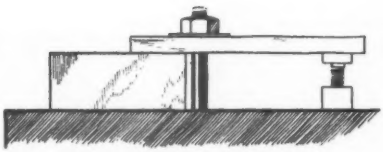
A single helical cutter should be mounted as shown in the bottom illustration. Here the cutting forces tend to force the cutter assembly into the spindle.

WRONG

Do not mount a helical cutter so that the horizontal cutting forces are tending to push the cutter assembly out of the spindle.

RIGHT

Place clamp stud close to workpiece for correct effective holding.

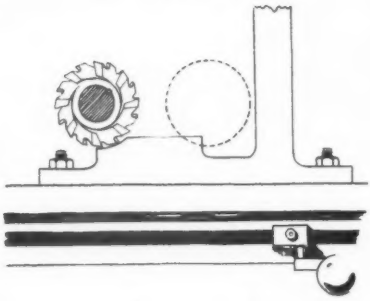


WRONG

It is wrong to place the clamp stud close to the jack because then the jack is clamped, not the workpiece.

RIGHT

Certain jobs with obstructions or definite length of cut demand use of feed trip dogs to limit the feed travel.

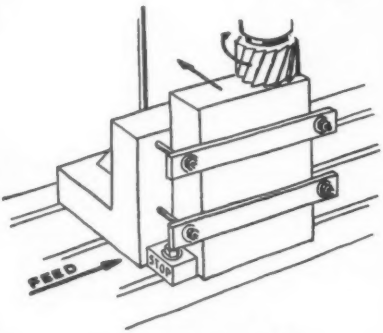


WRONG

Do not operate a milling machine without properly setting the feed trip dogs as there is danger of overfeeding.

RIGHT

Always direct the cutting forces against the solid part of the fixture and a supported part of the workpiece where they can be absorbed easily.

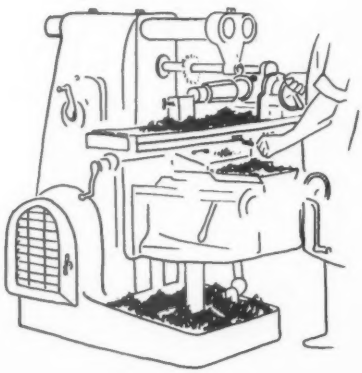


WRONG

Never direct the cutting forces in an operation against an unsupported portion of the workpiece or fixture as they cannot be counteracted properly.

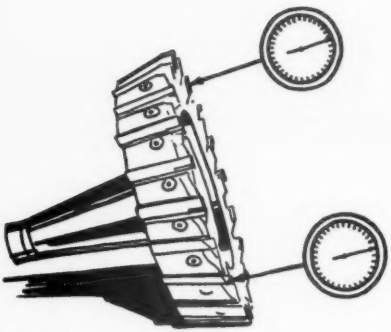
RIGHT

Never permit chips to accumulate on table, knee ways and column base. These are only unnecessary handicaps to good milling practice.



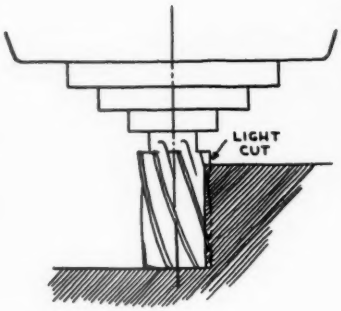
WRONG

Do not allow chips to accumulate on table, knee ways and column base as illustrated.



RIGHT

Tungsten carbide tipped face mill cutters should be ground with cutting edges in the same plane to two-tenths of one-thousandth of an inch (.0002).



RIGHT

When using an end mill decrease the depth of cut to prevent springing. Also the shank of the cutter should be gripped as close to the cutting edges as possible.

We are indebted to Kearney & Trecker Corp., The Cincinnati Milling Machine Co. and others who provided illustrations and textual data.

REPRINTS AVAILABLE

Defense training classes and department heads may obtain reprints of this special section on "Milling Technique" or the first in this series "Grinding Technique." Requests for copies should be addressed to THE TOOL & DIE JOURNAL, 2460 Fairmount Blvd., Cleveland, O.

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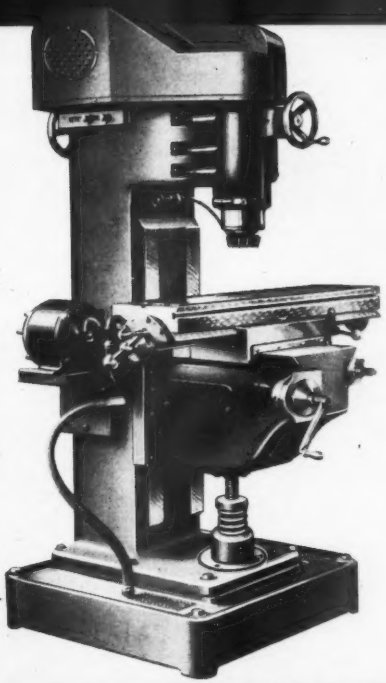

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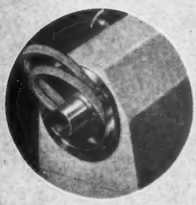
715 PLAIN BENCH LATHE



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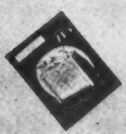
Convenient Drive Control

SPECIFICATIONS

Swing over bed, dia. ..... 7"
Distance between centers ..... 15"
Collet capacity, max. dia. ..... ¾"
Step chuck capacity, max. dia. ..... 5"
Jaw chuck capacity, max. dia. ..... 4"
Spindle capacity, max. dia. .... 55/84"
Slide rest, travel of tool post slide .. 4⅛"
Slide rest, travel of cross slide ..... 5"
Tailstock spindle travel ..... 3"
Spindle speeds:
Eight forward and reverse
150 to 3500 r.p.m.
Weight of lathe, mounting and drive, net ..... 650 lbs.



For Further Description
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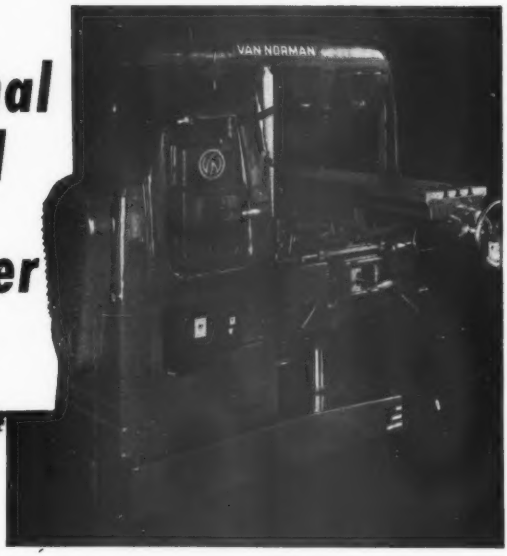

It is easy for the apprentice to learn and the skilled operator to remember that the table, knee and saddle of any Van Norman Miller travels in the same direction that the control levers are moved.

If the operator is standing in front or rear of the machine and wishes to move the table to the right, he moves the table control lever to the *right*. If he wants to raise the knee, he *lifts* the control lever for the knee. If he wants to lower the knee, he pushes this same lever *down*.

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Machine Tool Company, Springfield, Massachusetts

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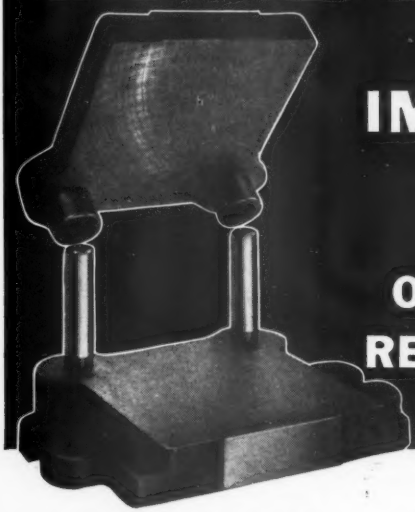

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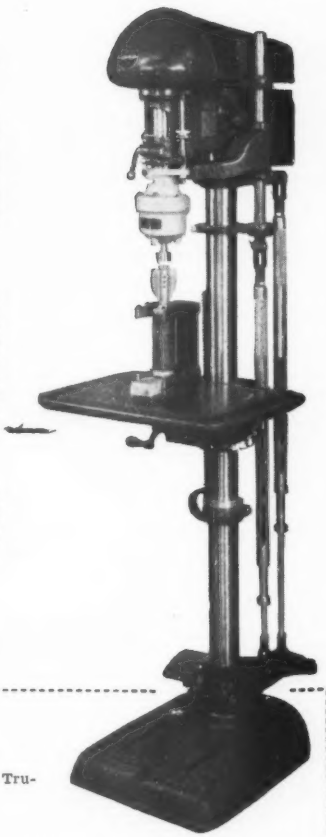
Speeds Up Assembly

Output Tremendously



By using a specially constructed tapping head, this Procunier Tapping Machine becomes an effective assembling unit. Items are assembled in a fraction of the time formerly required—and all to a uniform degree of tension. Then, if desired, the set-up can be quickly transformed back into a standard tapping machine. This unit here illustrated is being used to assemble caps and tail mechanism for military equipment. Many similar types of assembly jobs can be handled.

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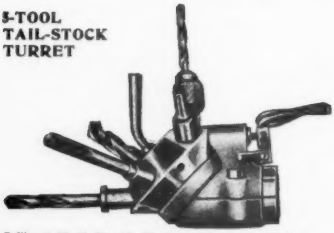
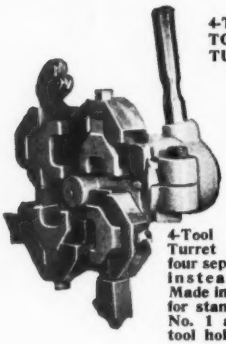
5-TOOL
TAIL-STOCK
TURRET



5-Tool Tail-Stock Turret accommodates five tools and each tool centers automatically when brought into position by means of an indexing plunger. Made in four sizes to fit small bench lathes up to lathes with 24" swing.

4-TOOL
TOOL-POST
TURRET



4-Tool Tool-Post Turret carries four separate tools instead of one. Made in two sizes for standard 0, 00, No. 1 and No. 2 tool holders.

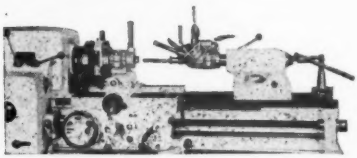


Photo above shows Jefferson Turret Attachments on 16" Engine Lathe.

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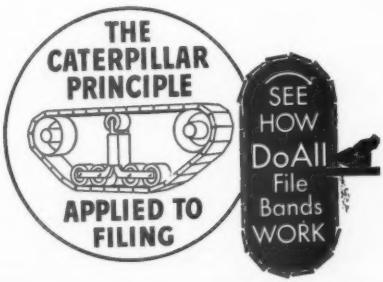

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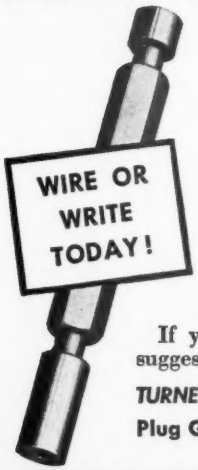

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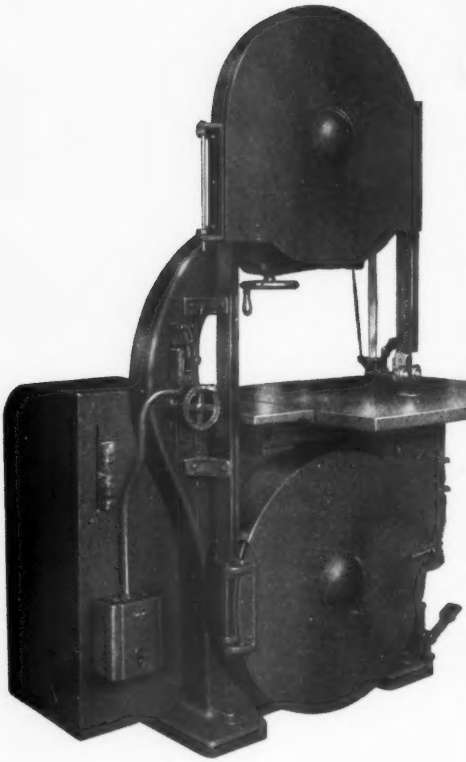

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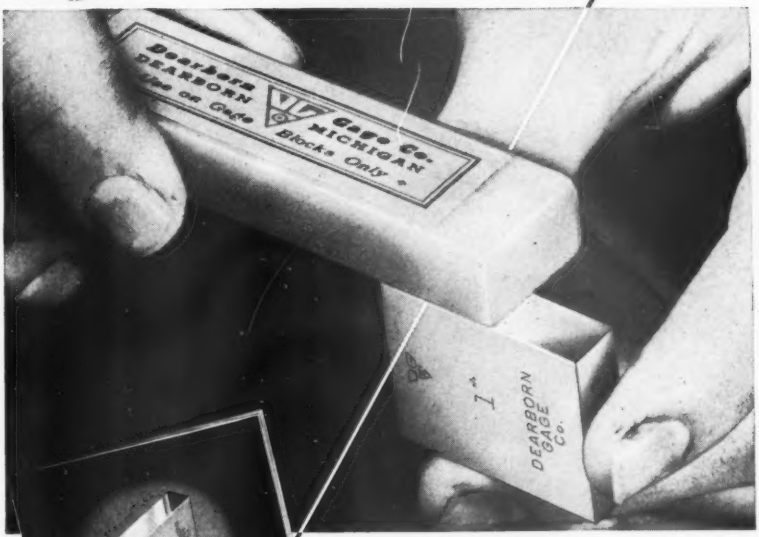

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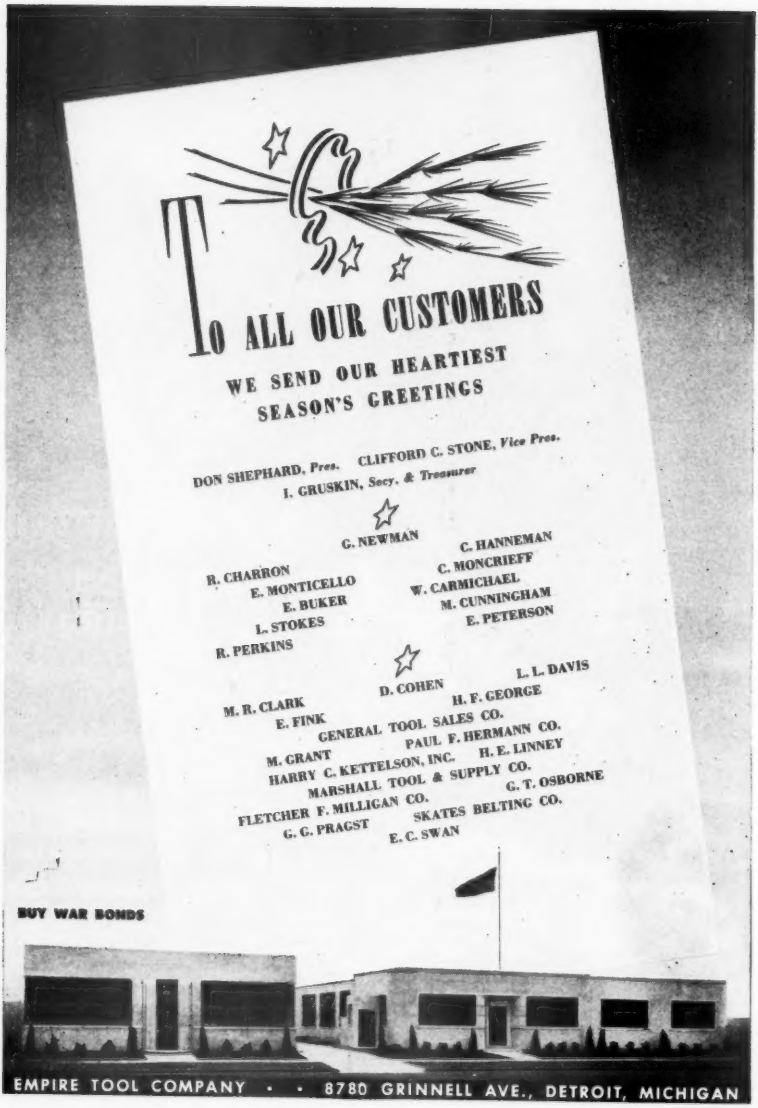
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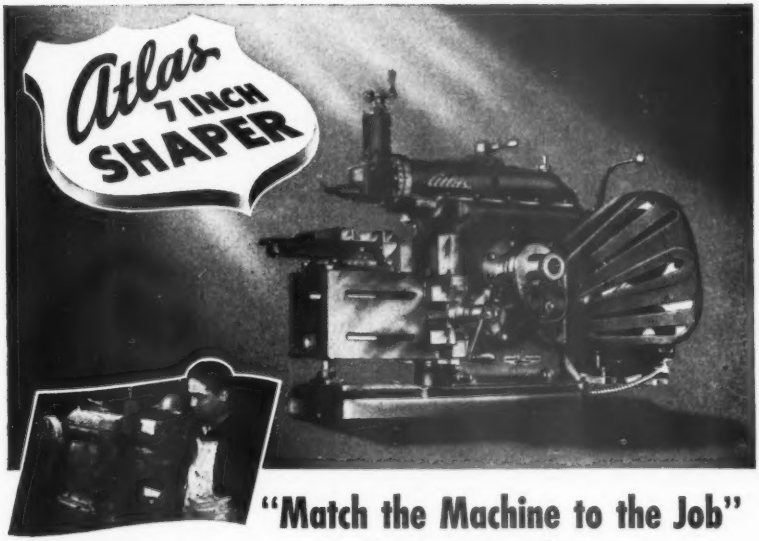


In [redacted] tool room, the Atlas Shaper makes snap gauges, small tools, and commutator dies.

"Match the Machine to the Job" for Top Production

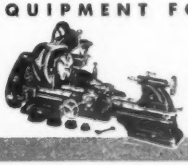
That fundamental idea — "Match the Machine to the Job" is an important reason why American war producers are forging to the front in the battle of production. The massive jigs and huge assemblies are monuments to American ingenuity and production power.

Just as important are the fast precision tools that *take over the production of small parts* so that the capacities of larger machines will not be wasted. The Atlas 7" Shaper is one of these valuable smaller tools. It handles everything within a 7" stroke. It is a counterpart of the larger shapers in precision, production and power, and is more flexible in set-ups. 5 automatic cross feeds in either direction and four speeds between 45 and 200 strokes per minute give a wide operating range. It has a complete V-belt drive, crank-type bull-gear drive, and operates from a ½ HP 1740 RPM motor. You will find Atlas Shapers in many of the plants that are winning "E" awards. Send for complete information. Atlas Press Company, 1212 N. Pitcher St., Kalamazoo, Michigan.

Atlas
ATLAS PRESS CO.
KALAMAZOO, MICH. U.S.A.

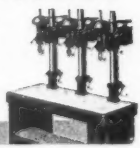
OTHER ATLAS EQUIPMENT FOR WAR PRODUCTION

MILLING MACHINES
Compact, powerful bench millers for full range of milling work.



LATHES
Backgeared, screw-cutting lathes with V-belt drive, power cross feed.

DRILLING MACHINES
Step up production on small-hole drilling, tapping. 4, 5, 2-spindle models.

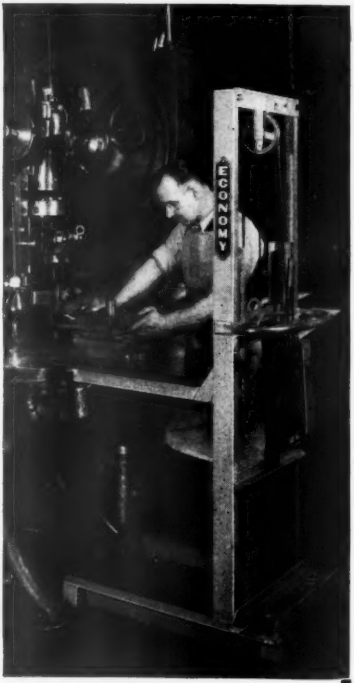


SAVE PRODUCTION TIME *with a* SHOPLIFTER

One man can handle heavy dies alone. Not necessary to stop other machines to get help.

MORE production per day from your machines if a Shoplifter is handy to do the heavy job of moving dies from storage racks to the press. In these times when maximum production of machines is of vital importance, much time and labor can be saved if the operator can handle the heavy work of changing dies without calling for help from other operators.

The Shoplifter is built for this job. Dependable and safe with a rated capacity of 500 lbs. (heavier machines up to 5000 lbs. can be furnished). Entire machine built of structural steel. Electrically welded throughout. Platform lifts 57" above floor and lowers to within 8¼" of floor. Overall height 72". Size of platform 24"x24" steel plate. Crank, up and down, hoist unit.



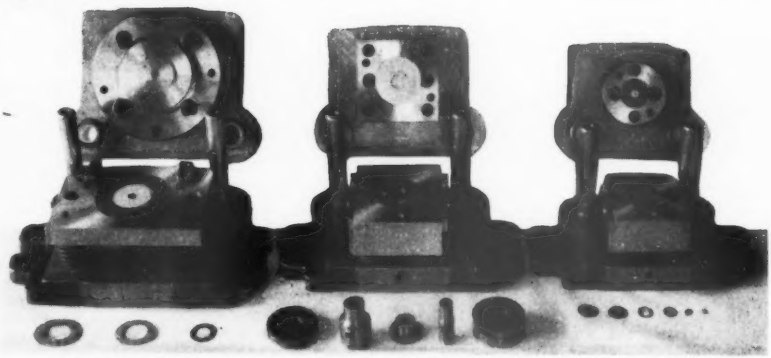
ECONOMY ENGINEERING CO.
2659 W. Van Buren St., Chicago

Price **$147.50**

IMMEDIATE DELIVERY

DON'T WASTE CRITICAL STEEL

Use HOVIS UNIVERSAL WASHER DIES



Capacity 2½" Dia. Capacity 1½" Dia. Capacity ¾" Dia.

NOTE THIS TREMENDOUS SAVING!

THE OLD WAY

To produce one washer, a small compound die requires approximately

40 to 45 LBS. OF CRITICAL STEEL

CAN YOU IMAGINE THE GREAT AMOUNT OF SPACE NEEDED FOR STORING AND CATALOGING 2000 OF THESE DIES. EACH ONE REQUIRING 1200 CUBIC INCHES?

THE HOVIS WAY

To make the same washer, one set of Interchangeable Parts for a Hovis ¾" Washer Die uses

ONLY 3 LBS. OF STEEL

A SURPRISINGLY SMALL SPACE IS ALL THAT IS NEEDED FOR STORING AND CATALOGING 2000 OF THESE SETS OF INTERCHANGEABLE PARTS. EACH SET REQUIRING ONLY ABOUT 28 CU. IN.!

Five simple, interchangeable parts are all the special tooling required to make a new size of washer by the Hovis method. The various interchangeable parts can be removed and replaced by the use of standard Hexagon Socket Screw Wrenches without dismantling the die in any way, the change being a matter of minutes. All these parts are held in by the Hovis Punch Retaining Mechanism. Naturally, the interests of economy and the victory program demand the use of Hovis Universal Washer Dies in today's production schedules.

HOVIS SCREWLOCK COMPANY

8100 E. Nine Mile Road - Van Dyke, Michigan

Suburb of Detroit *Phone: Centerline 1575*

Modern Milling Fixture Design

(Continued from Page 60)

The piece to be clamped may be a large casting, a rolled section or sheet metal work formed in dies. An elongated slot through the clamp and around stud *S* permits the clamp to be moved horizontally for removing and inserting the pieces. The work when inserted in the fixture is supported by spring-pin *P* which is depressed when the clamp is tightened.

This type of clamp with the attached roller holds the pieces securely when the nut is tightened, regardless of reasonable variations in shapes and thicknesses of work. The 45° angle and the general design can be altered, of course, to suit many shapes of work.

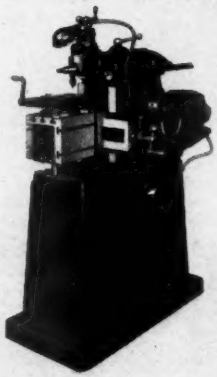
A Universal Indexing Head

A complete design for a milling fixture that any shop will find useful can be built from the drawing shown in Fig. 77. This fixture can be mounted on the table of a milling machine with spindle *B* either vertical or horizontal. The drawing shows this fixture setup for milling eight equally spaced ratchet teeth in four blanks at one setting. The indexing plate *C* can be removed easily and another plate with different indexing spaces substituted. For special work, the indexing spaces may not necessarily be equal. This is excellent equipment for cutting spur-gear teeth. It is also suitable for milling, drilling, slotting, grinding and jig boring operations.

This fixture has a cast semisteel body, but there is no reason why it could not be constructed of cold rolled steel plates and welded together. It is also possible to build this fixture much larger than indicated here. It could be large enough to take indexing plates 12" or more in diameter. This change would not interfere with milling small blanks and it would also take large work.

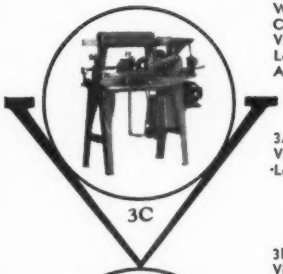
8 Inch Hy-Duty Shape-Rite Shaper

Modern war production requires precision machine tools. Shape-Rite Shapers meet all precision requirements in defense work. See your dealer or write us for further information.



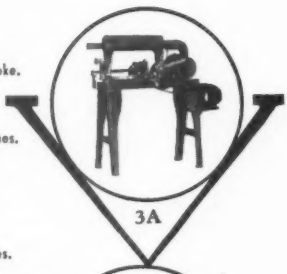
Sales Service & Mfg. Co.
473 N. Cleveland Avenue Saint Paul, Minnesota
U. S. A.

SALES SERVICE & MFG. CO. *Announces* — FIVE NEW KELLER POWER HACK SAWS



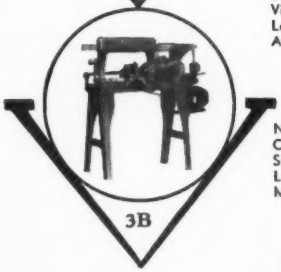
3C WET CUT SAW
With Coolant System.
Capacity 6¾ x 6¾ inches.
Vise swivels to 45 degrees.
Length of blade, 14 inches.
Automatic lift on reverse stroke.

3C



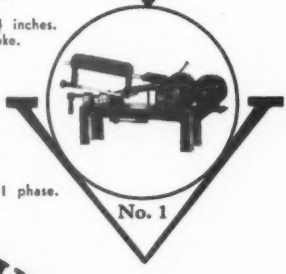
3A—Capacity 6¾ x 6¾ inches.
Vise swivels to 45 degrees.
Length of blade, 12 inches.

3A



3B—Capacity 6¾ x 6¾ inches.
Vise swivels to 45 degrees.
Length of blade, 12 to 14 inches.
Automatic lift on reverse stroke.

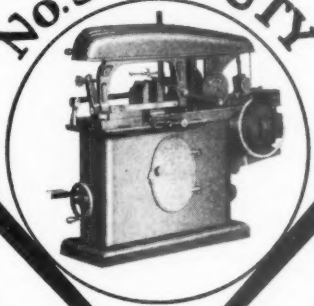
3B



No. 1 Bench Model
Capacity 4 x 4 inches.
Swivel vise, automatic stop.
Length of blade, 12 inches.
Motor, ¼ H.P. 60 cycle, 1 phase.

No. 1

No. 3 HY DUTY



No. 3 Hy Duty
Wet Cut
Capacity 6¾ x6 ¾.
Vise swivels to 45 degrees.
Capacity at 45 degrees, 4 inches.
With automatic safety stop.
Length of blade, 14 inches.
Two speeds available by shifting belts on V-belt pulley.
Foot lift for saw frame.
Feed pressure regulator.

Write
SALES SERVICE
& MFG. COMPANY
473 N. Cleveland Ave.
Saint Paul - Minnesota
Or See Your Nearest Dealer

OTHER INSTRUMENTS IN THE SCHERR LIMITED BUDGET INSPECTION LABORATORY

SPENCER BINOCULAR MICROSCOPE, with three dimensional vision, reveals surface finish, imperfections, etc.

SCHERR COMPARITOL for checking gage blocks, gages and work for size, accuracy and wear.

WILDER PROJECTOR for accurate measuring or comparing objects by means of a magnified shadow image.

ULTRA-CHEX—a 34 block set accurate to .000008"—providing a basic standard of measurements.

MAGNI-RAY — a wide-field illuminated magnifier for close inspection on a wide range of work and operations.

FOR PRODUCTION INSPECTION

ACCURATE GAGING

NOT DEPENDENT ON MEASURING SKILL

The demand for closer tolerances, at a time when skilled mechanics and toolmakers are difficult to obtain, makes the use of snap gages a practical necessity for accurate measurement of mass produced parts.

Through the use of ATLANTIC ADJUSTABLE LIMIT SNAP GAGES, accuracy in checking is made possible without dependence on the operator's skill or "feel" on which other measuring instruments depend for precise inspection. Once set, practically any operator can tell by the "GO" and "NO GO" parts of the ATLANTIC SNAP GAGE whether the part under inspection has been produced to the correct, specified limits. Faster inspection as well as more accurate results are assured—production as well as assembly can be stepped up.

ATLANTIC ADJUSTABLE LIMIT SNAP GAGES are manufactured in a modern gage and instrument shop with special machinery and tools and under proper atmospheric conditions for the finest machining, grinding and lapping. Gaging pins and anvils are hardened, ground, carefully lapped and must pass rigid tests for flatness and parallelism. Castings are of MEEHANITE to assure the maximum in rigidity and permanence of form and accuracy.

RANGE OF SIZES

Model A—in 10 Frame sizes and in size ranges from 0-½" to 5¼-6" inclusive

Model C—in 19 sizes ranging from 0-¼" to 5 $\frac{8}{16}$" to 5 $\frac{11}{16}$".

Send for detailed specifications

Write, Wire or Telephone (Canal 6-3512) For Quotations and Delivery Dates.

SCHERR SNAP GAGE STAND

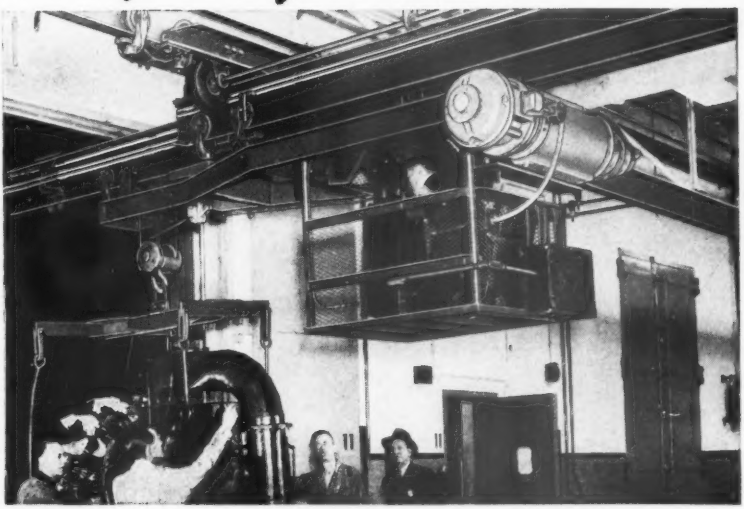
The SCHERR TOOL STAND provides a vise or clamp for holding micrometers, snap gages and other tools. It eliminates errors due to body heat and frees both hands for checking work. Price $7.50. Order Today!

GEORGE SCHERR COMPANY, INC.

128-B Lafayette Street, New York, New York

"AIR CARGO"

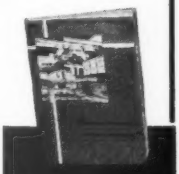
in your plant, too!



Proven over the years by
AMERICAN MONORAIL EQUIPMENT

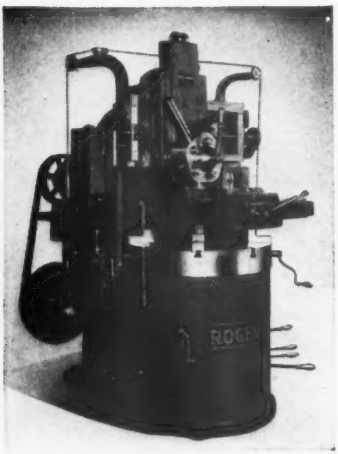
From raw materials to finished products, in every operation, American MonoRail Equipment is speeding up production in countless numbers of plants. There is no installation too large and none too small that will not increase production, reduce accidents, reduce employee fatigue, release skilled hands from handling jobs and result in savings of time and money.

American MonoRail Engineers will gladly show you how American MonoRail Equipment will do all these and more in your plant. Write today, no obligation.



WRITE FOR Blue Book illustrating hundreds of MonoRail installations.

THE AMERICAN MONORAIL CO.
13131 Athens Avenue Cleveland, Ohio



Two Heads Facilitate Two Simultaneous Operations

THE Rogers "Perfect 36" vertical turret mill is designed for fast, precision boring, drilling and turning ferrous and nonferrous castings, forgings and similar pieces. Convenient handling of the work, quick easy chucking, minimum setup time and fast traverse are but a few of the features which contribute to more finished pieces per hour.

The especially designed swivel side head and main head provide two operations on the work at the same time. By incorporating the swivel design in the side head, which allows the head to be set at any angle up to 35° either way, quicker and simpler tool setting for irregular pieces is made possible. Built-in graduated dial saves time in making setups for original and second runs. Large bearing area of tool stake and side rail, with positive clamping, assures rigidity and close tolerance work.

The table level horizontal chuck allows the work to slide easily and quickly into exact position.

The capacity of the turret mill is 36" in diameter. Table face to turret face is 24" maximum. Main head and side head have 8 vertical and horizontal feeds each. Spindle speeds can be set to any one of 8 speeds.

For complete information and catalog address Rogers Machine Works, Inc., 145 Arthur St., Buffalo, New York.

"Hard Chrome Plating Aids War Effort," an article by Arthur W. Logozzo, begins on page 50, this issue.

Special
CUTTING TOOLS
MADE TO
CUSTOMER'S
PRINTS
ALL
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For your specially designed cutting tools, A.C.E. offers a highly specialized experience to insure exact reproduction and rigid inspection that minimizes rejects. Many of the nation's leading defense plants use A.C.E. special cutting tools regularly. Integrity of product is our watchword. Send us your prints for estimate.
NOTE—we do not make tools for stock.
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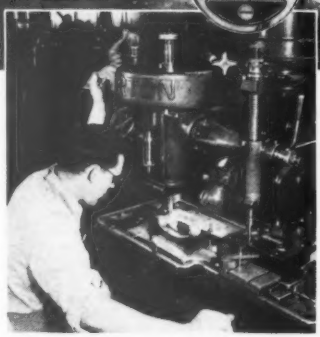
AMERICAN CUTTER
AND ENGINEERING CORP., WARREN, MICH.
SPECIALIZING IN HIGH SPEED CUTTING TOOLS TO YOUR PRINTS

A GORTON Equipped TOOL ROOM

HOW SPECIALIZED TOOL ROOMS HAVE *Standardized with* GORTON MACHINES *Matched Equipment* ACCESSORIES

"Made for Each Other"



TO INCREASE *Accuracy and Output*

Where "*performance of the first machine determines selection of the second,*" a large manufacturer of molded products uses Gorton Super-Speed Milling Machines for producing and duplicating molds, and incidental jigs and fixtures for plastic molding.

This Gorton standardized installation is typical of many similar. A glance at the above photo shows the predominance of Gorton Machines. Closer inspection of this modern, efficient tool room, generally regarded as one of the finest and best equipped in the plastics industry, discloses that it is completely outfitted with Gorton time-saving Accessories—Vises, Circular Tables and Cutting Tools, etc.—a "Matched Equipment" installation, setting new standards of efficiency for high-speed spindle jobs.

Gorton Super-Speed Precision Machines and Accessories are increasing production and improving accuracy in Tool Rooms and Production Plants throughout the country. Perhaps they can also help you secure better results.

FREE DATA AND ENGINEERING SERVICE

Our engineers will be glad to make suggestions and recommendations on your high-speed milling, duplicating and pantograph work without obligation. Send for our complete catalogs covering all types of Super-Speed Vertical Milling, Duplicating and Pantograph Engraving Machines. Ask for complete set of catalogs.

ONE JOB IN BRIEF

TYPICAL of one of the many operations performed in the tool room shown above, is the machining of a cavity of a section of mold for producing plastic handles. A brief outline of the job is as follows:

MACHINE—Gorton 9-J Vertical Milling Machine.

PART—Section of Mold for producing plastic handles.

MATERIAL—Crucible Steel Co. CSM #2.

CUTTER—Right hand cut; right hand spiral ¾" end mill.

OPERATION—Machining out cavity of section for plastic handle. Molding section and master fastened on top of Duplicator Table.

FEED—In this case the feed and speed, which naturally must be varied, are controlled by the operator.

CUSTOMER SAYS: "Through the use of the Gorton Machine, it is possible for the operator to cut very close to the required dimensions, thus reducing the amount of hand finishing to the minimum."

GEORGE GORTON MACHINE CO.

49 Years

1319 RACINE STREET, RACINE, WISCONSIN, U. S. A.

SPECIALISTS IN ENGRAVING, DIE MAKING AND SUPER-SPEED VERTICAL MILLING

Despatch Industrial Furnace Fans Available

HIGH temperature acid resistant fans of alloy steel used on Despatch industrial furnaces and ovens for the past seven years are now available to the trade. These fans are suited to virtually all heavy duty high volume requirements involving temperatures to 1600° F.

Their chief feature, in contrast to other fans of this type, is engineered design and construction combined with precision balancing. This assures unusual efficiency and smooth, quiet operation under widely varying service conditions.

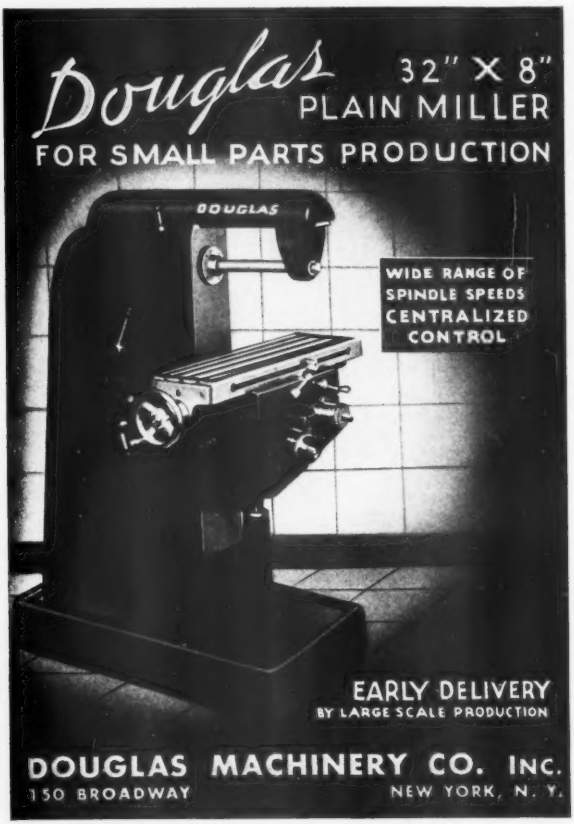
These fans are ruggedly constructed, being all-welded throughout. Pedestal, side and scroll sheets are heavy gage, having strong reinforcing angles. Other parts are equally tough and rigid to minimize vibration and withstand severe heat and load conditions.

Eleven sizes are available, ranging from 12" diameter wheels to 48" wheels, handling total pressures to 10" W. G.

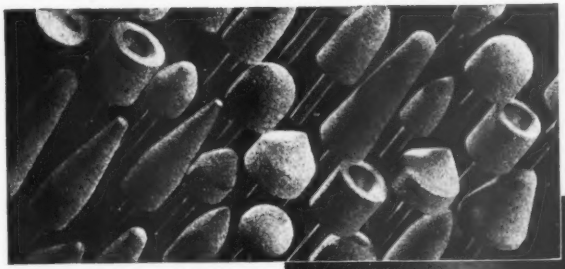
The shaft is supported on two large bearings which are air-cooled; a patented device dissipates heat from shaft before it reaches the bearings.

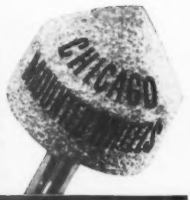
Various alloy steels are used, including 18-8, 25-12, Monel and Inconel, to permit handling chemical gases, fumes, special atmospheres, vapors, foundry dust, furnace and oven heat circulation and pickling tank exhausts at high temperatures.

Address Despatch Oven Co., 600 S.E. Ninth St., Minneapolis, Minn., for complete details.



Called for ACTIVE DUTY on the PRODUCTION FRONT





● We have a new job—to keep grinders going full blast all over the country in every war industry—in machine shops, tool rooms, experimental laboratories, repair departments, arsenals.

ATTENTION!

Our complete facilities are now devoted to making CHICAGO Mounted Wheels and Vitrified Grinding Wheels 3" and under in diameter. We're proud and happy to be given this definite and important part in the War Program. Our work goes on night and day supplying these vital aids for Victory.

Send us your priority orders for mounted and unmounted grinding wheels up to and including 3" in diameter. You will get the right wheel for the job—when you want it.

We no longer manufacture the larger grinding wheels. We're sorry to have to disappoint our good customers (many of whom have been with us for half a century) on their orders for Vitrified Wheels over 3" in diameter.

Specializing on high production of Mounted Wheels, Cut-off Wheels and small Vitrified Grinding Wheels will be our job until the war is won. We know you will understand.

YOU SHOULD HAVE OUR NEW CATALOG

It shows in actual colors and exact sizes the most complete line of Mounted Wheels made. Send for copy today.

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America's Headquarters for Mounted Wheels
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Please send new Chicago Mounted Wheel Catalog
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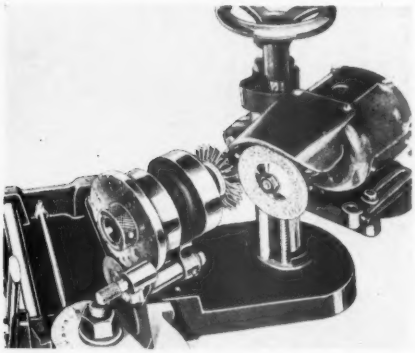
Hilco Grinder Has Index Dividing Head



EXTREME flexibility; quick, low-cost setups without disturbance to production grinders; wide cutter range applicability; and absence of vibration are features of the new Hilco universal cutter grinder.

The index dividing head is the heart of the Hilco grinder. It has seven index circles consisting of micrometer placed holes or stops, which insure perfect uniformity of cutting edges in the finished cutter regardless of the number of teeth or cutting surfaces. Any simple or compound angle may be quickly set up to accommodate any type of cutter.

The Hilco is furnished with an interchangeable table or flat bed attachment. Regardless of the type tool ground last, it may be quickly set up for another type cutter. It will grind to perfect sharpness any concave, convex, helical, straight or tapered angle or special cutter up to 6" in diameter—regardless of cutting angle required.

This is a bench type machine and occupies little space. It is ideal for tool cribs in large plants where spare time can be used to sharpen all cutters.

Berco Mfg. Co., 425 W. Superior St., Chicago, Ill., will send complete details.

"Plastics in Battledress" is an interesting article on British wartime plastics procedures.

Maximum Tool Life
***plus* Maximum Production**
—Use CROBALT!

● A superior heat resisting chromium-cobalt-tungsten high speed cutting alloy. Permits higher speeds with longer tool life.

Eliminates the possibility of chipping. Combines maximum production with minimum cost per piece.

Catalog rushed on request . . .

Write Dept. A

CROBALT INC.
ANN ARBOR, MICHIGAN

CROBALT

A NEW TYPE MACHINE

DEVLIEG JIGMIL

No. 3-A
3" BAR

To more accurately and speedily serve the broad field needing a machine having

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THE SPACING ACCURACY OF A JIG BORER

• • •

THE PERFORMANCE QUALITIES OF A MILLING MACHINE

• • •

THE CONVENIENCE AND FLEXIBILITY OF A HORIZONTAL BORING MILL

☆ A PRECISION MACHINE ☆

Featuring

NEW SPEED OF OPERATION

NEW ADVANCED FINGER TIP CONTROLS

NEW STANDARDS OF EXCELLENCE OF BORED HOLES

NEW ACCURACY IN MILLING

AUTOMATIC TABLE RETRACTION AND REPOSITIONING

Many machines in operation show 75% greater average daily productivity and improved dependability for precision.

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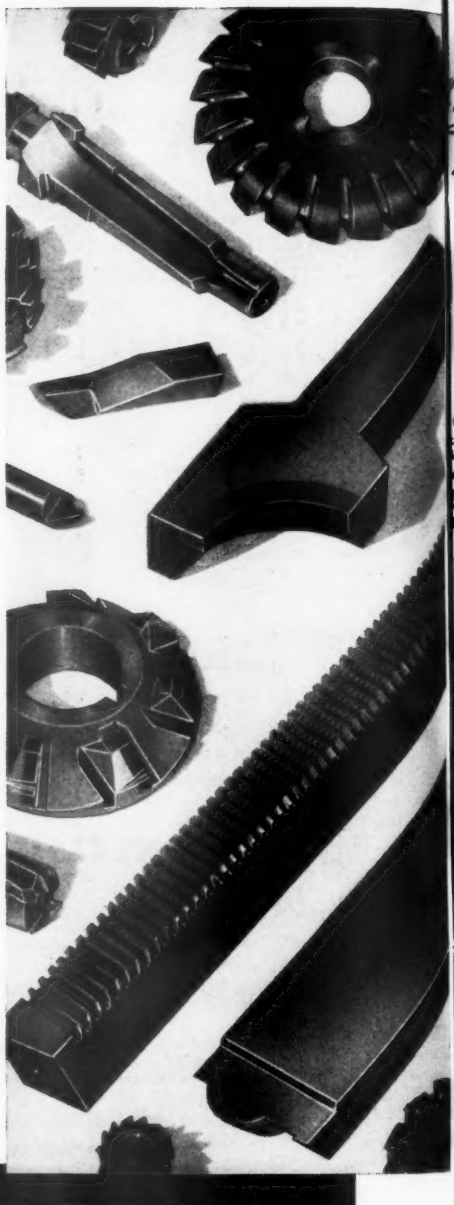
DEVLIEG MACHINE COMPANY
452 FAIR AVENUE, FERNDALE (DETROIT), MICHIGAN

DEVLIEG MACHINE TOOLS

CONTINENTAL CUTTING TOOLS

CUTTING TOOLS must now yield the maximum in accuracy and production—only the best will stand up satisfactorily under the strenuous pace a nation at war demands. This is why cutting tools designed and made by the Continental Tool Division of Ex-Cell-O Corporation are so widely preferred.

Continental Tool Division
EX-CELL-O CORPORATION • DETROIT



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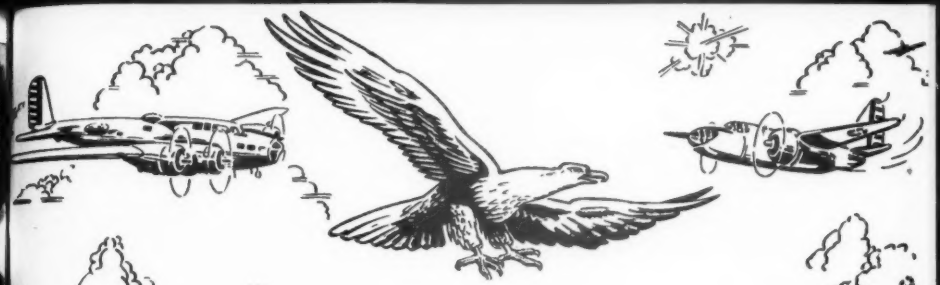
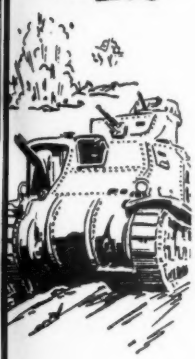


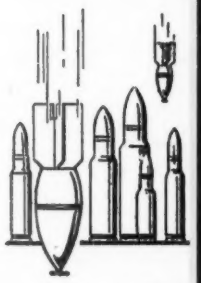
PLASTICATOR

GORDON B. THAYER*
Technical Consultant

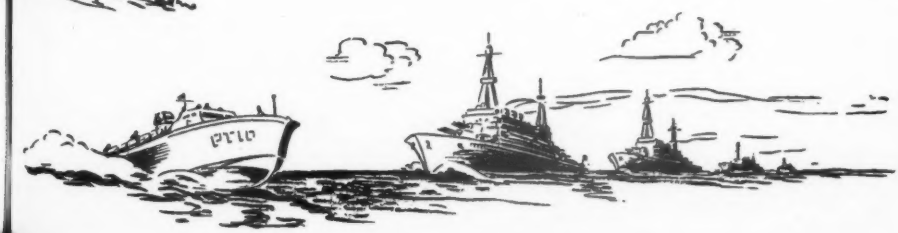
NONFERROUS metals have a place in plastics mold construction as it is often difficult to find available machine time to build a steel mold for simple parts. In many cases, a cast mold of nonferrous material is suitable for samples and can be produced by a type of skilled workman not in such great demand as the toolmaker and with equipment which is not tied up in building tools for production.

Mr. Dewar of Plastics Industries Technical Institute presents in this issue of the Plasticator some helpful data on the use of nonferrous metals in plastics mold construction.





Research Engineer, Dow Chemical Co.



British Plastics in Battledress

by F. G. Woodiwiss
London County Council
Lecturer and Instructor

The plastics industry in Great Britain has turned its energies to war. A united effort has resulted under the guidance of the British Plastics Federation.

THE war is making great differences in plastics molding in Britain. At first perhaps the question of mold design and construction was not given its due merit. Molders did not appreciate the risks that go with the production of individual high quality tools of this type or that an increase in its cost followed the shortage of highly skilled labor. Neither did they always realize that each new design for a plastics piece presented new problems in mold design, which often could only be solved by research added to past experience.

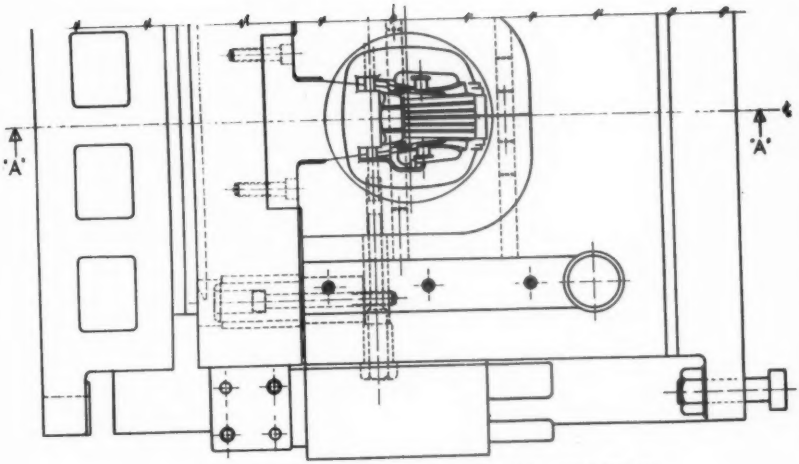
It is to the credit of British mold makers that their ingenuity has solved many problems, but in the past they were often severely criticized for their apparently high prices. The great advancement in the qualities and utilities of molding compounds and their growing markets, however, has enforced greater cooperation between mold maker and user. The British Plastics Federation has done much to foster this cooperative attitude, as well as to encourage the pooling of information and ideas and to establish the united industry as it is today.

There is still some shortage of skilled tool room workers in Britain. To alleviate this condition the Ministry of Labor has instituted training centers where talent spotters recommend selected trainees from engineering workshop courses to take extended training in plastics mold making. It is not expected that a few months intensive training will produce qualified mold makers, but such trainees are successfully diluting the industry. On certain jobs many have become sufficiently reliable to do some actual mold making and maintenance work demanding a fair amount of skill. Women are employed on millers and grinders and some do a certain amount of fitting. During the past year the face of the industry in Britain has been completely changed. The colorful peacetime roles of plastics materials have almost disappeared—British plastics are now in battledress.

Thermoplastics Sheets

The manipulation of thermoplastics sheets has made great strides, which are likely to form the foundation of an extensive peacetime industry. One interesting war application is the molding to

(Continued on Page 114)



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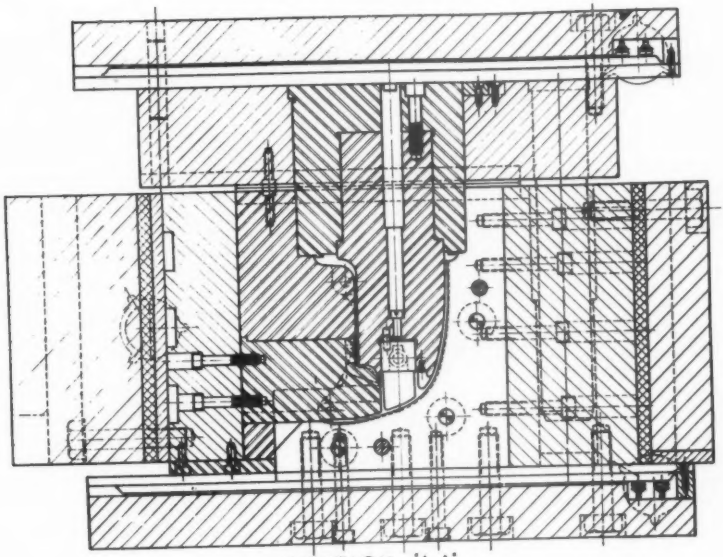


SECTION 'A A'

Fig. 1

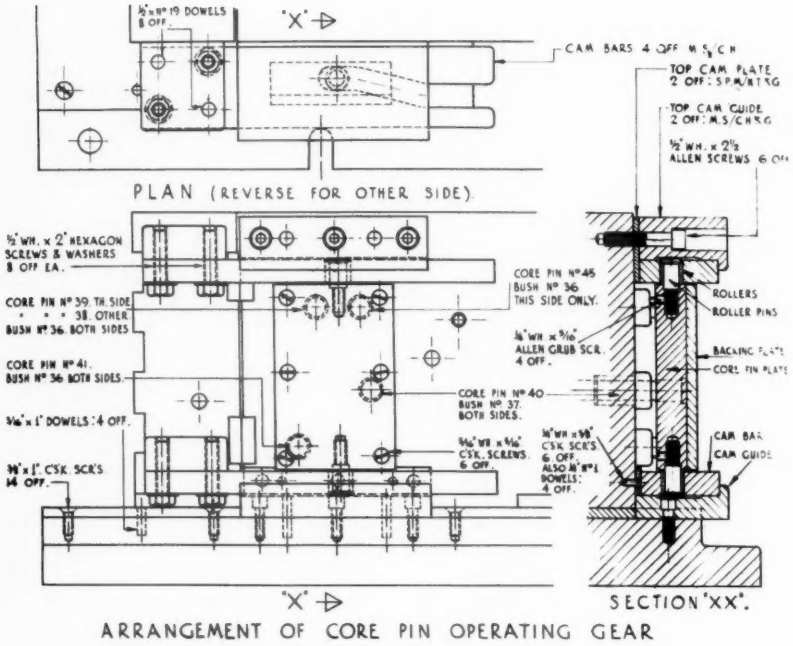


Fig. 2

specification of plastics eye lenses for the services. About 9,000 different molds are being prepared for this job.

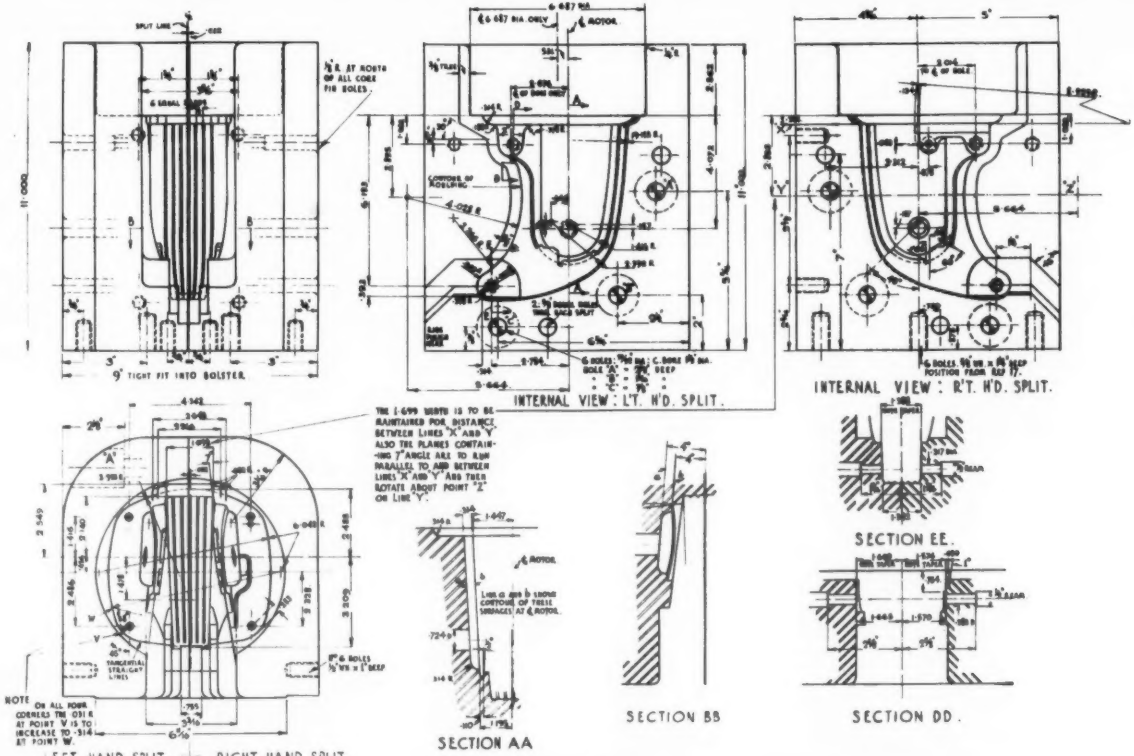
A big effort has been made to get the full capacity from each molding press. In this connection several firms have had some of their single daylight presses fitted with an extra middle platen so that two shallow molds can be utilized when formerly only one was used. To meet a shortage of gland packing materials and to lengthen the life of pump plungers, the latter are being chromium plated. Chrome plating is also being used to a greater extent on molds in preference to stainless steel because of the difficulty of finding labor to fabricate this refractory material.

The British technique of plastics molding does not differ fundamentally from the American, either in the materials used, molding procedure, equipment employed or mold making methods. Such differences as there are arise because of the smaller markets which were catered to in Britain in prewar days. In design and construction the general run of molds in Britain are perhaps simpler. The use of cam assembling and disassembling arrangements to minimize manual operations are not warranted for the lower productions.

General Tool Room Practice

Mold making follows general tool room practice with perhaps greater use of hobbing presses and duplicating machines, although at present these are not used to the same extent as in the United States. A leading British tool and die making firm, who reckon twenty percent of their business is occupied in plastics mold making and who made the mold described below, have their hobbing, engraving and chromium plating sent out. They have shops full of mill-

(Continued on Page 154)



DETAILS ETC OF BOTTOM IMPRESSION. 1 OFF EACH : C.N.L/R.T.&G.

Fig. 3

Nonferrous Metals in Plastics Mold Construction

New ideas in plastics mold construction are eagerly sought by our armed forces.

Mr. Dewar's research with nonferrous metals for use in plastics mold construction contributes to this idea pool.

by Wm. J. Dewar
Research Engineer
Plastics Industries Technical Institute

PLASTICATOR

PERHAPS the most familiar application of nonferrous metals to plastics mold construction is that in which a lead antimony alloy is used for the production of cast phenolic plastics. A hardened nondeforming cold steel arbor is dipped in a bath of molten alloy and the resultant encrustation, when stripped off the arbor, forms the mold for the liquid casting resin. The metal in this case serves admirably in that it is inert to the resin, gives an excellent finish, can be easily removed from the hardened plastics and eventually used for other work when remelted.

The other types of plastics molding are compression, injection and extrusion. In compression molding a dry, powdered, fairly abrasive molding compound is placed in a heated mold and shaped and hardened under pressures of from 1,000 to 5,000 psi. A steel mold that produces thousands of similar articles without showing appreciable wear must be heat treated so as to have special properties. The mold must have a tough core to withstand the impact and pressure of closing as well as a hardened surface to resist abrasion.

In injection and extrusion, much higher pressures may be encountered and, because of the flow of the plastics, there is considerable wear on the mold surfaces. Injection molds are not always hardened although the sprue bushing that contacts the heater nozzle should be so protected. The molds seldom get hotter than 150° F, even though the injected plastics material may be in the neighborhood of 450° F.

For extrusion purposes, the die must be capable of withstanding temperatures that might range upward to 400° F. Because of the streamlined nature and consequent compound curvature of extrusion dies they sometimes present complicated machining problems which can be easily overcome by casting.

In choosing a material other than steel, numerous requirements have to be taken into consideration. First, the temperature which will be required. The type of molding material to be used is also to be considered in that there is a possibility of reaction with the metal, although a chromium or nickel plate will generally eliminate corrosion. If the mold is to be used for production and not for experimental purposes, how many cavities will be needed and what tolerances must be met should be considered. Where exact dimensional accuracy is not necessary, the mold may be readily cast. In the reproduction of ornamental designs the advantages of cast metal molds over the difficult milling that would be required for steel is quite apparent. In multiple cavity molds where hobbing is resorted to there is seldom any advantage in using anything but steel.

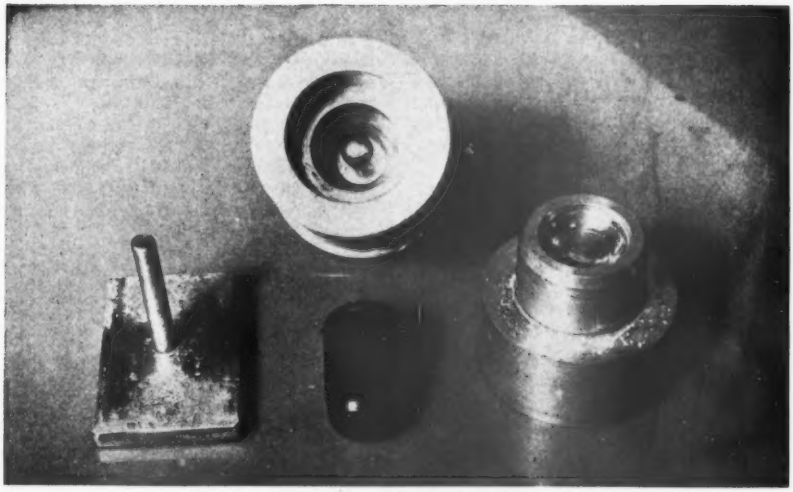


Fig. 1.—Zinc alloy mold and molded piece.

The closest approach to the characteristics of steel for molds is a beryllium-copper-cobalt alloy. A copper base alloy, containing about 2% beryllium and .5% cobalt, is recommended for cast molds. It has an approximate tensile strength of 150,000 psi, a compressive strength of 190,000 psi and a proportional limit of 85,000 psi. On heat treating at 600° F for three hours it will harden clear through to about 40 Rockwell C. It is for this property of hardening throughout that designs incorporating thin sections are to be avoided. The advantages of the cobalt content are that the alloy may be held at the heat treating temperature for periods longer than three hours without danger of annealing. The danger of warping and cracking sometimes found in binary alloys is minimized.

For casting the alloy, an ordinary sand mold is prepared from the negative pattern of the object to be manufactured. In constructing the mold, shrinkage coefficients of the alloys must be considered—that of beryllium copper being about .016" per linear inch. A fine green sand of approximately 7% moisture content is used. A parting powder such as stearic acid or lycopodium provides a good release from the pattern. As in all sand casting, the sand should not be tamped too firmly because some permeability of the mold is required to allow escape of gas during pouring. For intricate castings it is good practice to provide vents in the under side of the sand as auxiliary gas passages. The sand mold should always be baked to remove moisture as well as to char the parting powder and thereby prevent gas formation. To avoid intricate coring jobs for steam ports, it is good practice to cast a pipe conduit integral with the mold to carry the steam through the finished mold.

Beryllium copper alloys are best melted in vacuum electric furnaces at a temperature of from 1900° F to 2000° F. If the melt is covered with charcoal it helps prevent oxidation while pouring into the sand molds. This procedure gives a casting that requires little finishing to be ready for molding, although the use of either a centrifugal or pressure casting technique gives a much finer detail and, therefore, truer reproduction. After a perfunctory burnishing and finishing, the mold is given a heat treatment. This hardening procedure should be carried out in a non-oxidizing atmosphere at a temperature of about 600° F for a period of three hours. Of course, the mold should be adequately supported during the heating to prevent warpage. Guide pins and bushings are then inserted and the mold, with a little cleaning, is ready for use. Beryllium copper molds have given excellent results in thermosetting work and compare favorably with ordinary

steels.

In the case of thermoplastics compression molding, beryllium alloy molds have often been superior to steel in increasing production, because their high thermal conductivity gives rise to faster heating and cooling.

An alloy of zinc, copper, aluminum and magnesium has been used successfully for experimental work and for limited production. This alloy is cast at a temperature of about 900° F and is handled in the same manner as beryllium alloys. The sand mold is prepared in the same way, but because of the lower temperature at which the alloy melts, less expensive equipment is needed. The alloy has a compressive strength of about 60,000 psi and a tensile strength of about 35,000 psi. Although it cannot be hardened, the alloy will withstand the rigors of limited molding without deformation. The preferred practice is to use a steel chase to hold the alloy and thereby give the necessary strength without extra bulk. This alloy is easily polished with a burnishing tool and fine abrasives. The shrinkage coefficient is about .012" per linear inch, but since it is so easy to work, it is customary to cast oversize and machine down. In common with other zinc base alloys pressure casting, if possible, will give much better reproduction.

Lead has been found useful at the Plastics Industries Technical Institute in the making of experimental injection molds. Because of the priority situation on other metals, lead has been adopted as a substitute. It is also easily cast in the same manner as the alloys and, even better, can be dressed down with ordinary wood working tools. Thus, numerous design techniques as to gating and venting can be tried, using the same cavity. Since its thermal conductivity is approximately the same as steel, experimental results as to design can be readily transferred to steel. Thin or unsupported sections are to be avoided, as lead is deformed by comparatively small stresses. At the Institute, a steel form or chase is used to hold experimental lead inserts which have stood up under 16,000 psi injection pressures. Lead is not recommended for production work because of its limitations. As an experimental material, however, it has certainly been useful.

Even though cast materials are on the critical list, the advantages of fast, low cost mold construction far outweigh the low strength and inadequate finish potentialities.

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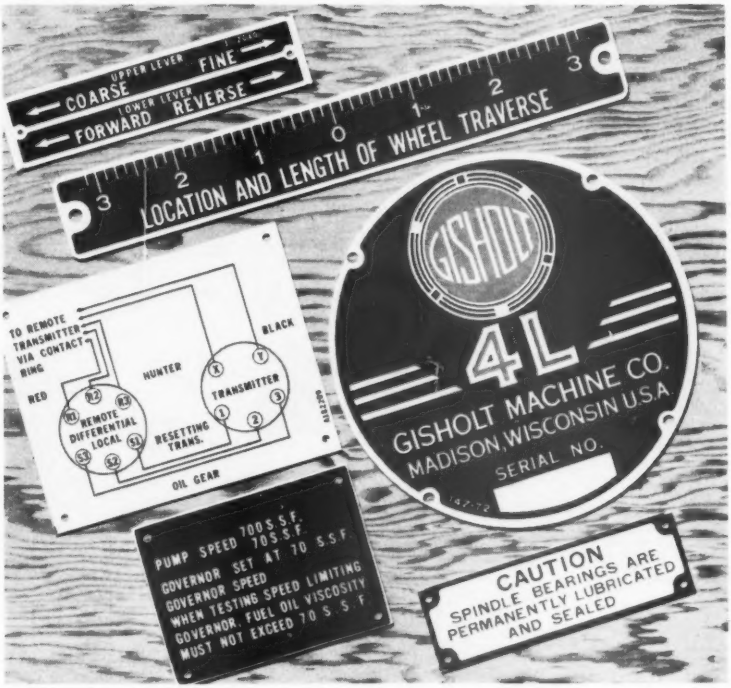

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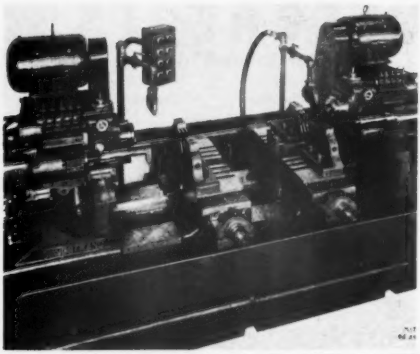

THE Sundstrand Machine Tool Co. has recently put into production a new double-end milling and centering machine suitable for milling to length and centering — in one handling—both ends of shafts ranging from 1⅛" to 6" diameter by 14" to 72" long.

The machine base is a one-piece cast iron unit having horizontal ways. Crosswise to the bed ways are mounted two sub-bases which, in turn, have ways on which cross feeding heads are attached. The left hand sub-base is fixed, but the right hand base is adjustable for handling various lengths of stock. Mounted to the bed ways between the two heads are two screw operated self-centering vises for holding the work. These vises also are adjustable for handling various lengths.

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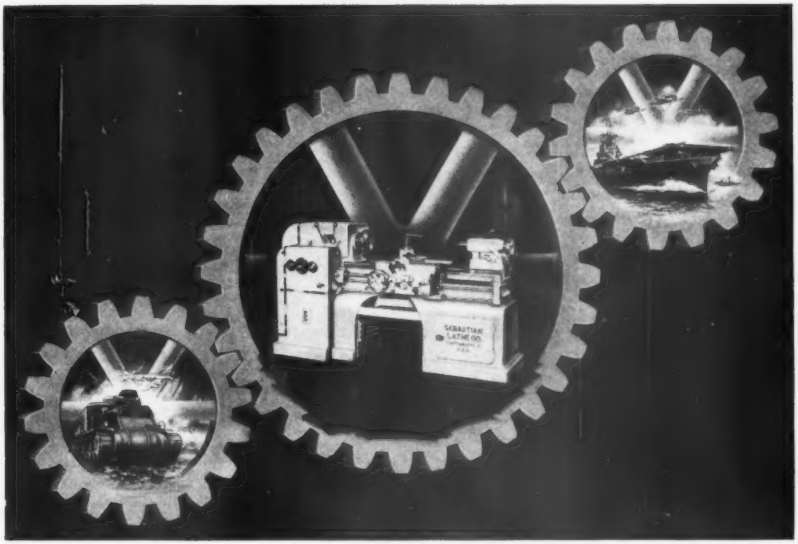

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Brazing High Speed Steel

(Continued from Page 66)

speed steel tip may occur more uniformly and with less danger of cracking the tip. The result of this procedure, which takes about 15 minutes for an ordinary size tool, is that the tip is in the tempered condition and brazed firmly to the shank. A subsequent temper at 1050° F for one hour is recommended for the purpose of stress relief and will have practically no effect on the hardness of the tip.

Three goose-necked tools tipped with high-carbon, high-vanadium high speed steel by the braze-tempering method, are shown in Fig. 3. The largest tool shown measures 20" in length and weighs 18 pounds, while its tip weighs only about two ounces or less than one percent of the tool. The assembly used in braze-tempering is illustrated in Fig. 4. A hardness survey was also made on a braze-tempered tipped tool. The tip retained its initial high hardness. The hardness of the shank was unaffected by braze-tempering except directly below the tip where the critical temperature was exceeded by direct contact with the oxy-acetylene flame and the subsequent oil quench (followed by an air cool) caused hardening.

Comparison of Two Methods

As compared with the braze-hardening method, the braze-tempering method is less suited to making tools required to take heavy cuts. In taking heavy roughing cuts, sufficient heat may be developed to cause softening of the silver alloy braze and consequent movement of the tip. For this reason, it is preferable to use braze-tempered tools mainly for finishing cuts. Since, however, copper softens at a much higher temperature than silver solder, braze-hardened tools can be used to take either roughing or finishing cuts as desired. Another advantage of the braze-hardening method is that substantial hardening of the shank takes place, while in the case of the braze-tempering method the shank is relatively unhardened. This means that the braze-hardened tool shank is stronger and will have less tendency to take a permanent set due to bending in taking a heavy cut. Of course, the shanks used for braze-tempered tools could be previously hardened to develop

(Cont'd on Page 123)

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(Continued from Page 122)

a strength equivalent to that secured in braze-hardened shanks, but an extra heat treating operation is required. In the case of braze-hardening, it is necessary that the shank steel possess resistance to excessive grain coarsening because of the high temperature involved. This requirement is not necessary in the case of braze-tempering because the shanks are subjected to a much lower temperature.

Conservation

There are several advantages in using tools tipped with high speed steel by the two brazing methods. First in importance is the saving of high speed steel, which means conservation of strategic metals as well as lowering of tool cost. The amount of high speed steel saved depends upon the design of the tool. For ordinary straight lathe tools which are reforged and rehardened until half their original length is used up, the saving is estimated as 75%; while for special shaped tools it may be as high as 99%. This economy makes it possible to use special high speed steels such as high-carbon, high-vanadium, and the cobalt types which give superior performance to ordinary high speed steel in certain applications. Although these special compositions contain relatively large percentages of strategic metals, their use in tipped tools would be practical. As an example, consider the case of a medium size goosenecked tool weighing 5½ pounds tipped with high-carbon, high-vanadium high speed steel which contains 4% of strategic vanadium. The vanadium content of the entire tool (assuming the shank steel contains no vanadium) amounts to about .08%. Compared with the vanadium in a high-carbon, high-vanadium high speed steel (4%) which would give the same life or in a solid tool of ordinary high speed steel (about 1%) which would perform far less efficiently on a job requiring high resistance to abrasion, the consumption of vanadium in the tipped tools is insignificant.

Salvaging Discarded Solid Tools

Conservation of high speed steel may

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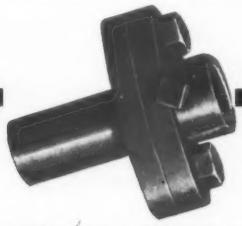

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(Continued from Page 123)

also be accomplished by salvaging solid tools which have been discarded as undersize. These tools may be annealed and then cut up into appropriate tip sizes. This method of conservation is very important in the case of special high speed steel compositions which will become more and more difficult to obtain as time goes on.

Added Advantages

Besides conservation of high speed steel, there are other advantages in the use of tipped tools by the brazing methods. Since only the tip is fully hardened, there is less danger of the tool cracking or harmful internal stresses being set up than in the case of hardening a solid tool, especially one having a complicated shape. Breakage of tools may also be avoided by the use of tough alloy steel shanks in tipped tools, particularly for those applications involving shock. Cutting efficiency will also be increased since it is easier to obtain full hardness in a tip than in a large solid tool. Likewise, using a tough shank, the tip can be used at a higher hardness than would be used in solid tools for applications involving shock. The cost of making a tipped tool compares favorably with that of making a solid tool even without taking into account the saving in high speed steel.

At Watertown Arsenal, both methods of brazing have proven successful and high speed steel tipped tools are being substituted for solid tools wherever possible. Thus far, these methods have been used mainly for lathe tools. The limiting factor in the application of these methods is the difficulty involved in brazing and, therefore, they would be of little advantage in making complicated drills or special shaped cutters.

Other Methods

Various methods of making high speed steel tipped tools, besides brazing, are in use. These include mechanical fasteners, inserting, welding and cementing. Some of these methods are comparatively new and their relative advantages have not yet been established. However, these methods are available and if adopted on a nation wide scale, they would result in a considerable saving of strategic metals. In view of the present shortage of these metals, the adoption of high speed steel tipped tools wherever possible is considered a patriotic duty besides offering definite economic advantages.

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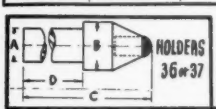

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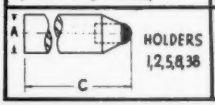
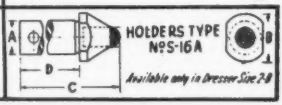




CARBOLOY Diamond Impregnated WHEEL DRESSERS

EQUIP YOUR PRESS
FOR DEEP DRAWING
for as low as
$50.00 complete
There is a DAYTON ROGERS Pneumatic Die Cushion that will equip your press for deep drawing work such as that shown above.
The Die Cushion is a complete, self-contained, easily attached unit that automatically maintains a predetermined cushioning pressure on either the drawing or pressure pad at all times.
Available in size from 4" to 24" with a maximum drawing capacity of 10" and ring holding pressures up to 15 tons.
Write for complete details.
DAYTON ROGERS MFG. CO.
2835 12th Ave. S. Minneapolis, Minn.

Convert Your Single Action Presses Into Double Action Presses With This Pneumatic Die Cushion.

Accidents — Saboteur of Manpower

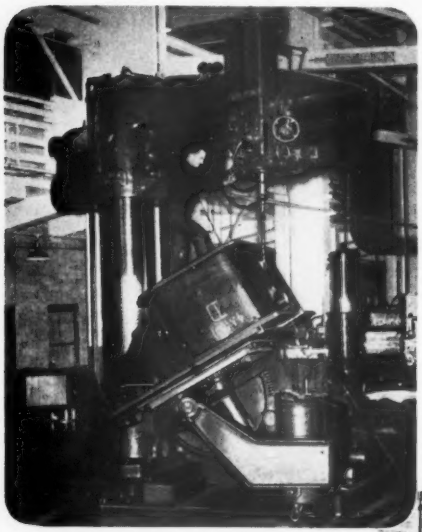
LED by business and industry, America is organizing the greatest counterattack on accidents in all history. Faced by mounting casualties on the homefront already exceeding those on the fighting front, the country is at last taking unified action to curb the sabotage of manpower by accident.

Since Pearl Harbor 85,000 persons in all have been killed by accident in the United States, 7,700,000 injured. Destruction of human material at this tremendous rate means something more than personal tragedy endlessly repeated. It means that 410,000,000 man-days of work have been lost. These man-days might better have been spent turning out tanks, planes, guns, ships and the thousand and one complementary materials of war.

Of these fatalities 42,000 were workers—at a time when manpower is the Nation's major nonmilitary concern. Only one out of eight industrial establishments—there are 196,000 in all—is fully covered by a safety program. Even more alarming, three out of five workers injured were struck down, not in line of duty at furnace, press or lathe, but off the job. Whatever the background of our accident experience, its end effects are a gross waste of skills, serious lapses of efficiency while replacements are trained and steady impairment of morale. When the trend has reached a pitch where ten firms are required to keep careless Americans supplied with glass eyes and twenty-five more with crutches, the time is ripe to call a halt.

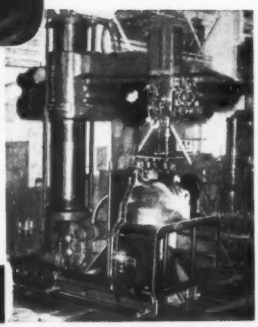
A halt has been called. The first move was made by the President of the United States, in a proclamation calling on the National Safety Council "to mobilize its

(Cont'd on Page 127)



Drills 4 Sides with 1 Set-up

By mounting these castings on a C-F Welding Positioner the operator can turn the work completely around and tilt it at any angle up to 135° off horizontal with a push button control—can drill all sides and the top with one set-up.



★ (Above) Drilling an angle hole. (Right) With work tilted at 90°, work is revolved to drill each side in turn.

CULLEN-FRIESTEDT CO.
1316 S. KILBOURN AVE. CHICAGO, ILLINOIS

(Continued from Page 126)

nation-wide resources in leading a concerted and intensified campaign against accidents."

The National Safety Council had thirty years of invaluable experience to draw on. It had plenty of ideas for concrete action. It knew exactly what it would need in the way of increased staff and public cooperation. But to move into wartime high gear with a program big enough to meet the national accident crisis, money for an adequate emergency budget was needed.

At this point business and industry stepped to the fore. In a spirit of wartime public service, representative leaders decided to undertake the financing of the Council's biggest assignment, and organized the War Production Fund to Conserve Manpower. William A. Irvin, former president of the United States Steel Corporation, accepted the national chairmanship of the Fund, and Thomas W. Lamont of J. P. Morgan and Company became treasurer. A goal of $5,000,000 was agreed on, this sum to be raised from business and industry throughout the country.

The War Production Fund movement has received the blanket endorsement of President Roosevelt and of Donald M. Nelson, chairman of the WPB. The Fund has been expressly approved by the National Association of Manufacturers, by the directors of the American Iron and Steel Institute, by the Western Association of Railway Executives, the Eastern Railroad's Presidents Conference and many other important national organizations.

Joseph A. Moore, president of the Moore Drydock Company, said in a radio address:

"We have an enormous job to do and we can't do it without the support and cooperation of business and industry. Accidents can and must be prevented if we are to mobilize this country for all-out war production. Industry can and must take the leadership in this movement. We are asking for the support of all business. It has been abundantly proved that safety pays off in money, in time and in war production."

Many big firms have contributed heavily to the War Production Fund despite the fact they already have excellent safety programs in effect. They are aware that some outside agency with specialized experience is needed to coordinate safety off the job, where three out of five accidents affecting workers

(Continued on Page 128)

MAKE YOUR CORRUGATED BOXES DO A BETTER JOB—GET THIS BOOKLET

F R E E

When stacking and loading operations are efficient, your corrugated boxes will travel better, with less damage in transit, and provide greater conservation of materials, time and space.

The first step in achieving such efficiency, such savings, is to write or phone for your free copy of H & D's new booklet, "How To Stack and Load Corrugated Boxes." The practical information it contains will show you how to get maximum service from the corrugated shipping boxes you use. There's no obligation; get your free copy today.

THE HINDE & DAUCH
PAPER COMPANY
4264 Decatur St. Sandusky, Ohio

BETTER SEE H&D
AUTHORITY ON PACKAGING

(Continued from Page 127)

happen. They will also welcome technical assistance in handling the brand new problems of safety for the army of women in industry and of safety in the homes temporarily neglected for drill press and assembly bench. The same goes for accident prevention methods to protect 'teen age boys and older men now filling the shoes of men drawn into the armed services.

The National Safety Council has worked out a very careful plan for putting the $5,000,000 to work. No radical departures from previous practice are contemplated. The general strategy will be to speed up the existing program, to get more coverage, more technical assistance in the field and above all more public cooperation in accident prevention.

The national aspect of the accident problem is underscored in Council planning, the overall need as contrasted with an aggregate of scattered needs.

The Council has detailed plans for reenergizing the safety movement in several directions. Cooperative programs to reduce off-the-job accidents will get serious attention. More technical assistance will be furnished plants already having safety programs and will be introduced into the thousands of plants now unprotected. A great deal of thought has been given to plans for extending the safety training programs in public schools, trade schools and engineering colleges. A strong effort will be made to educate the general public in safety and for this purpose greater use will be made of the press, magazine and radio. Methods for handling congested traffic in war industry centers will be tried out. The problem of handling traffic to facilitate great troop movements is on the Council's agenda. Above all, the collaboration of private and public agencies—Department of Labor, the Army and Navy, State boards of education, etc.—will be sought to create an adequate web of safety control.

In a recent address before the National Safety Congress in Chicago, William A. Irvin had this to say:

"In terms of its importance to the war effort and in terms of its day-by-day social and economic significance to the Nation, the safety movement is ten times as important as many other movements that get ten times its public recognition and support."

Use Them Over and Over

DE-STA-CO ARBOR SPACERS

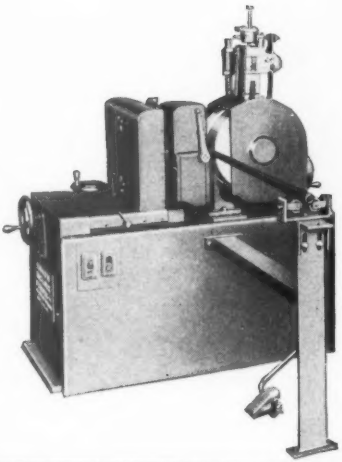
Measured by the number of times they can be used, De-Sta-Co Spacers are the lowest in cost of any spacers you can buy. Made of metal, they are not affected by oil or heat. Use these spacers for quick set-up of milling machine cutters and wherever low cost, accurate spacing is required.

Stock sizes .001" to .125" thick. Specials, any length, cut from bar stock, ground to decimal.

TRIAL ASSORTMENT—enough for average use on one machine sent for $1.00. Give arbor size. *Size and price list sent FREE!*

DETROIT STAMPING CO.
Established Over 25 Years
344 Midland Ave • Detroit, Mich.

New Machine Utilizes Surface Coated Abrasive Belts



THE machine illustrated shows but one of a number of ways in which the Outside Diameter Cylindrical Finishing Machine can be arranged, using for the polishing numbers a special wheel with Auto-Doper-Dyer adapted to the particular work. The machine may also be arranged with backstand idler pulley and patented segment face contact wheel, permitting use of surface coated abrasive belts for polishing and finishing.

The new method of utilizing surface coated abrasive belts instead of setup polishing wheels is said to increase production and effect striking savings.

The Hammond cylindrical finishing machine is designed with a range of feed of 9′ to 50′ per minute for 1″ diameter, forward or reverse. This would permit inexperienced operators to secure quality finishes at high production rates. A quick release lever enables the operator to control the work from the face of the wheel. The work support is adjustable to the wheel by quick simple means for work of varying diameters. All parts of the OD Machine are carefully guarded and easily accessible.

Complete information is available from Hammond Machinery Builders, Inc., 1631 Douglas Ave., Kalamazoo, Mich.

Pocket Size

This Amazing Chart

40 equations quickly found. Eliminates errors. Determines angles & dimensions, without higher math.

Makes TRIGONOMETRY Easy

Machine Shop — Tool Die — Jig Bore — Patterns
Layout — Inspection — Drafting

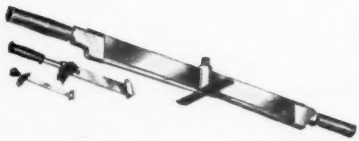
BREAK TIME-WASTING BOTTLENECKS with the TRIG-EASY CHART, for every man whose work requires solution of problems involving angles. Saves his own time and time of those who must wait for calculations.
Correct equation is always instantly found with TRIG-EASY. Pays for itself every time used. Only 50c. (60c Canadian) with complete instructions. MONEY-BACK GUARANTEE. 18,000 in use today. If your dealer can't supply you, order direct.

TRIG-EASY
E. H. NEEDHAM
3635D WESLEY ST., CULVER CITY, CALIF.
QUANTITY DISCOUNT TO INDUSTRIAL FIRMS

Progress on Parade

THE Dazor floating arm lamp is available with both 24" and 34" arm extensions. This model, with 9¾" reflector, can be brought down as close to the working surface as desired, or floated with a touch to any other position. For mounting in limited space Dazor Mfg. Co., 4480 Duncan Ave., St. Louis, Mo., also supplies an adjustable rigid arm model.

* * *



A COMPLETE line of torque wrenches range in size from a few inch pound capacity to a two-handled torque wrench of 7200 inch pound capacity. These wrenches are widely used for both assembly and inspection to gage or measure the torque applied when tightening critical screws and bolts and to equalize, control or bring screws to a predetermined torque. Made by P. A. Sturtevant Co., Dept. T-J, Addison, Ill.

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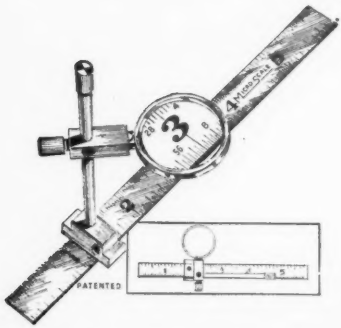
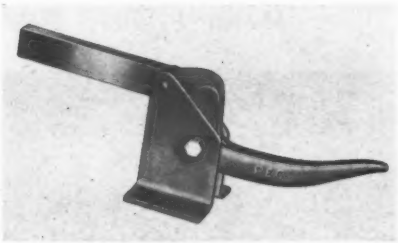


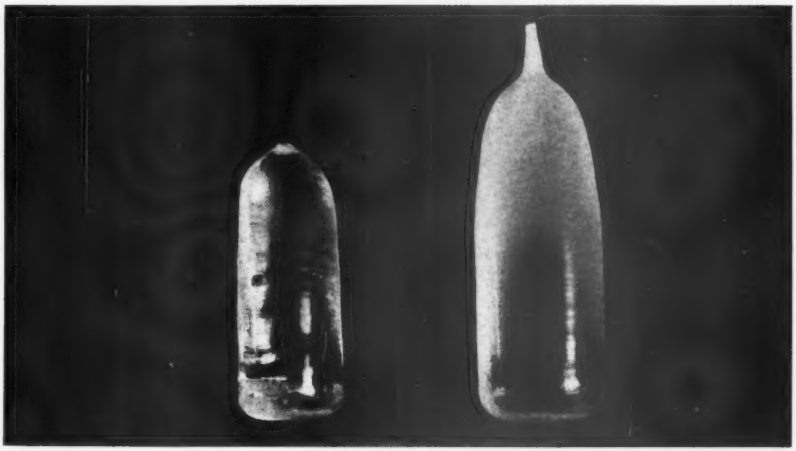
DESIGNED for aircraft, ordnance, electrical, metal and all other workers who do close work, the patented magnifying machinist scale is a great asset in measuring center distances accurately. With the "Micro-Scale" the tool maker can see such fine divisions as a 64th, about four times its normal size. This permits work to a few thousandths since a 64th can be split with a scriber. Manufactured by the Leonard Engineering Co., Capitol View, Md., and distributed by the L. V. Fox Co., Inc., Dept. T-12, Washington, D. C.

A NEW line of selfadjusting jig clamps that can be locked in infinite positions up to 15° above or below horizontal is now in production at Products Engineering Corp., 701 E. Florence Ave., Los Angeles, Cal. Use of the Pec clamp, according to the manufacturer, will make it possible to carry a much smaller stock of jig clamps as one Pec, with its greater range, will do the work of many nonadjustable clamps.



FLEXIBLE die handling equipment not only reduces idle press time and accidents but also permits dies to be easily carried away from the press department for storage in another section of the plant. The illustration shows a truck made by the Baker Industrial Truck Div., The Baker-Raulang Co., 2150 W. 25th St., Cleveland, O., removing a die from a drop hammer.

INSTIGATED by the need of a domestic source of industrial gems, The Linde Air Products Co., 31 E. 42nd St., New York, N. Y., is now manufacturing boules of synthetic white sapphire. They serve economically as the jewel bearings of chronometers, compasses and electrical, fire control, and aircraft instruments. They have been used experimentally as rollers for small needle bearings and for cutting tool tips to perform high speed finishing operations on certain nonferrous metals.



"Motor Finder" For Rapid Motor Selection

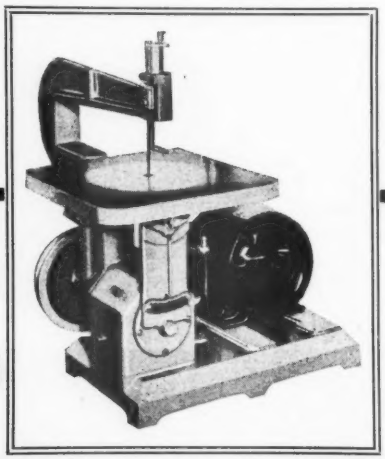
TO help motor users fill their wartime motor needs with the least possible delay, as well as to conform to recent WPB recommendations, Allis-Chalmers now offers a new "Motor Finder" for quickly selecting the various types of squirrel-cage motors.

Standard types of squirrel-cage motors are actually even more versatile than is commonly realized. Because of this and the important savings in time and materials achieved due to standardization, WPB is urging careful consideration of the squirrel-cage types.

With the Motor Finder slide rule, the user is able to match the conditions under which the motor must operate at the proposed installation with the required motor characteristics and instantly learn the right motor type and its features.

So handy is the Motor Finder that only three simple steps are necessary to pick a motor. Since over 30 standard types, covering a range in horsepower from ½ to 75, are included in the Allis-Chalmers Lo-Maintenance line, all of the characteristics of squirrel-cage motors are immediately considered in using the slide-rule. The potential motor user thus takes fullest advantage of the motors available in wartime.

Copies may be obtained free on request from Allis-Chalmers Mfg. Co., Dept. SR, Milwaukee, Wis.



Price, complete with motor— **$125** Net

F.O.B. Chicago

IMMEDIATE DELIVERY—Atlas Die Filing Machines

Can be used for all kinds of die making. The overarm is constructed so that the file and saw attachments may be interchanged with little effort. The holddown fingers are attached directly to the overarm. Working surface of the table, which tilts two directions, is entirely clear. An improved type of chuck, consisting of movable hardened jaws, holds both saws and files. Screw adjustment makes changes easy and fast.

ATLAS EQUIPMENT CO.

101 S. Clinton St. Chicago, Ill.

Detroit Distributor—International Machinery Co.

3131 E. Jefferson Ave. Detroit, Mich.

Victory Spacers Adaptable To Standard Milling Machine

A NEW straddle milling spacer, which saves hours of setup time over the conventional type, has been announced. Known as the Rousselle Victory adjustable spacer, it was developed by Edward Rousselle, expert machine tool designer, to save for actual production work the hours normally spent in grinding conventional spacers to accurate size for straddle milling.

The Victory spacer is simply slipped into the arbor, together with conventional type spacers, and is then screwed to a setting accurate to .001" and locked into position by the inner locking ring. Adjustment for length is approximately ½".

These spacers are made of alloy steel, hardened and ground, and accurately threaded and finished. A range of 5 standard arbor diameters (1", 1¼", 1½", 1¾", and 2") permits their adaptability to all standard milling machines.

David J. Ross Co., Benton Harbor, Mich., has available a new bulletin describing and illustrating the Rousselle Victory Spacers. Send for your copy.

An Apology

Blank & Buxton Company, Jackson, Mich., are sole distributors of the Index Mills and not the designers, as implied in a short story on these Mills in our November issue, page 141. The Index Mills are manufactured by Index Machine & Tool Company.

MODELS 10-14 FEATURE THE *NEW* PATENTED

NO SPRAY NO SPLASH WHEEL GUARDS

"You're Dry when you grind Wet"

Guards are concealed, easily accessible, maximum light and operation freedom around the wheels.

WRITE FOR BULLETIN 201

Other Hammond Grinders: "4" Combination Chipbreaker and Grinder; 6, 10A, and 20S Carbide Tool Grinders.

Hammond OF KALAMAZOO

CARBIDE TOOL GRINDERS

MODELS 4, 6, 10, 14, 20

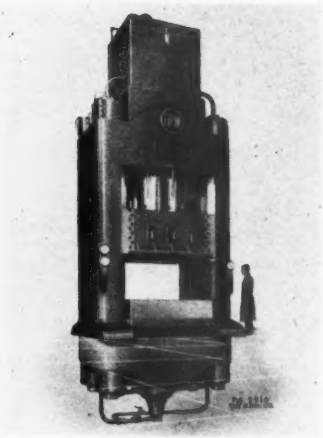
Models 10 - 14

Hammond Machinery Builders INC.

★ ★ ★ 1631 DOUGLAS AVENUE ★ ★ ★

KALAMAZOO • MICHIGAN

EASTERN BRANCH 71 W. 23rd STREET, NEW YORK CITY



Three-Way Operation Featured in H-P-M Presses

THE completion of one of the world's largest self-contained deep metal drawing presses, capable of deep drawing heavy steel plate to a depth of 18", has been announced by Hydraulic Press Mfg. Co. The Fastraverse press embodies two hydraulic actions —a 3500-ton downward acting die platen and a 1000-ton ton hydraulic die cushion in the press bed.

The die cushion press may be effectively operated on varied lengths of stroke and at full pressure capacity for any distance. Also, with the die cushion idle, the press can be used for single action pressing, such as coining, sizing, and straightening.

Oil trapped in the die cushion cylinder is intensified by the downward acting movement of the main press slide. This intensified pressure produces the resistance force necessary for holding the blank.

The H-P-M closed circuit operating system provides for complete and accurate control of press ram movements without an operating valve. The press ram is reversed by reversing the delivery of the H-P-M Hydro-Power radial pump. Reversal is smooth and shockless. The press may be operated in any one of three ways—manual, semi-automatic or full automatic. Change-over from one mode of operation to another can be made quickly by the operator at the electric control station.

Hydraulic Press Mfg. Co., Dept. T-12, Mt. Gilead, O., will send specifications.

SCIENCE *will win the* **WAR!**

Our Services

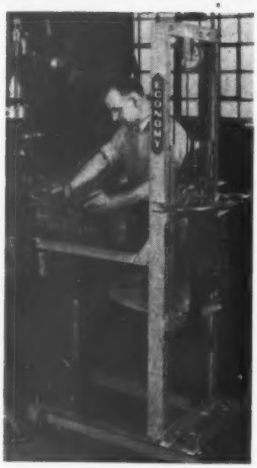
Flame Hardening · Annealing · Aerocasing · Bar Stock Treating and Straightening · Heat Treating · Pack or Gas Carburizing · Sand Blasting · Chapmanizing · Tempering · Cyaniding · Nitriding · Hi-Speed Hardening

METAL TREATING INSTITUTE

THE LAKESIDE STEEL IMPROVEMENT CO.

5418 Lakeside Avenue CLEVELAND, OHIO Phone Henderson 9100

Shop-Lifter Handles Dies Efficiently



THE Economy Shop-Lifter was designed primarily for the safe, speedy and efficient handling of dies. It can be used for lifting heavy mold parts; for stacking boxes, skids, drums; as an adjustable table for machine work; and as a truck for material handling.

A sturdy hand-operated hoist raises and lowers the platform to any desired height between limits of travel. It is a crank up-and-down type unit with automatic clutch holding the load at whatever point raised. The clutch is connected through pinion shaft to a ratchet and pawl. Cranking backwards releases the ratchet automatically and lowers the platform under control of the operator. Spur gears, ¼" steel cable and a 12" crank handle are furnished.

Base wheels of ample size make the Shop-Lifter as flexible as a hand truck when moving a full load through the shop.

Specifications are: Type—D; Capacity—500 pounds; Overall height—72"; Platform lift—57" above floor level, lowers to within 8¼" of floor; Base frame—24" wide by 33" long; Platform—24" wide by 24", steel plate; Entire frame of machine is of structural steel, electrically arc welded throughout.

Economy Engineering Co., 2659 W. Van Buren St., Chicago, Ill., will supply full specifications and descriptive literature at your request.

Federal Taperlock

***Plastic* GAGE HANDLES**

Immediate Delivery!

★ Made of durable plastic material, they are lighter than any metals used for Gage Handles.

★ This light weight makes gages more sensitive to touch and reduces fatigue caused by long continuous use—particularly in the case of women inspectors. Insulates from bodily heat, helping maintain accuracy of gages.

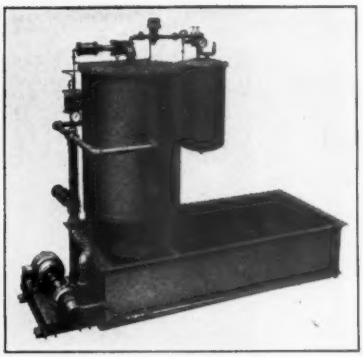
★ Made to fit gages of standard sizes. Easily marked for identification with the same lettering used for metal handles.

★ The low cost represents a real saving. **Available in 6 standard sizes, in any quantity and without delay.**

★ **COLORS!!!** A new feature in Federal Gage Handles. Permits quick identification of types or sizes without measuring gages. Available in BLACK—RED—YELLOW—GREEN.

FEDERAL TOOL CORPORATION

400 North Leavitt Street **Chicago, Illinois**



Speedy Abrasive Removal With Automatic Clarifier

THE Honan-Crane Automatic Clarifier has been designed for the speedy removal of abrasives from oils and coolants used in boring, cutting, grinding and similar operations.

The removal of abrasives must be accomplished as fast as they are formed. The rate of flow through the Clarifier must be as rapid as the rate of flow through the operating machines. The Honan-Crane Clarifier meets this problem of removing abrasives from oils and coolants at the high rate necessary for speedy mass production. This effective removal guarantees better finish, longer tool life and reduction in time lost in grinding tools and dressing stones.

Every feature of construction has been carefully engineered to give years of automatic, trouble-free service. Inlet manifolds give a swirling action to incoming oil that properly distributes the oil over the entire surface of the filtering cloth. This swirling action also continuously washes large particles from the filtering surface. An air pressure tank carries a sufficient volume of air to thoroughly flush the filtering screen in the backwashing operation. A float valve automatically controls the oil level in the blow down tank, preventing overflow.

Address Honan-Crane Corp., 208 Indianapolis Ave., Lebanon, Ind., for descriptive Bulletin 26.

KENNAMETAL*...

Style 11

the lathe tool that will expand your *Production*

KENNAMETAL'S qualities of hardness, crater resistance, and transverse rupture strength combine to give increased production on turning, boring, or facing operations on steel.

The illustration shows a style 11 KENNAMETAL tool taking a turning cut on a tinning roll at a speed of 210 ft./min. with a cut of ¼" depth and 1/32" feed. Note the finish achieved on the initial cut; KENNAMETAL, by frequently taking a finish and rough cut in one operation, decreases floor to floor time and increases production.

For your boring, turning, and facing operations on steel, use KENNAMETAL for increased production with current equipment.

KENNAMETAL THE All American CARBIDE

*Invented and Manufactured in U.S.A.

McKENNA METALS Co.

500 LLOYD AVE., LATROBE, PA.

Foreign Sales: U.S. STEEL EXPORT CO., 30 Church St., New York
Exclusive of Canada and Great Britain

Interchangeability of Jaw Plates Featured in Universal Vise

THE Universal 3-Way Vise holds work rigidly for milling, drilling, boring, reaming, grinding, shaping, die sinking, checking —in fact for any operation on or off a machine tool involving either single or compound angles. It is ideal for grinding complex tool bit shapes, for drilling holes at hard-to-get-at angles — for milling tool blanks for carbide inserts.

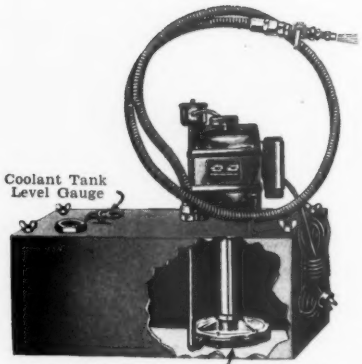
This vise can replace many special fixtures. Ease of setting any complex angle and interchangeability of jaw plates make the Universal an ever-ready fixture for short or long runs, saving time, trouble and expense.

Because of the unusually large jaw opening, width and depth, the standard hardened steel jaw plates can be readily replaced with any specially shaped jaw plates for round or odd shaped work.

The cradles and base are held securely in set position by arc-shaped locking wedges, each providing a long, positive wedge lock in its mating groove. Many tool room jobs can actually be held with the locking bolts only finger tight.

The Universal 3-Way Vise is fully portable and may be moved from machine to machine without removing the work or disturbing the work angle.

Universal Vise and Tool Co., Parma, Mich., will send Circular V at your request.



Instantly Removable Intake Strainer

Production Increased 300%

A COMPLETE line of portable coolant pump systems, known as Spiegel-Spray, is being manufactured by G. B. Spiegel Corp. These pumps are suitable for 24-hour production on lathes, screw machines, drill presses, grinders, milling machines, for tapping and finishing operations.

Special features include: nonclogging centrifugal pump with no gears or close fitted parts to wear or jam; no metal-to-metal contact; removable strainer; completely portable, self-contained unit; accurate flow control valve delivering just the right amount of coolant with spray nozzle to deliver coolant exactly where needed.

Speeding up production and increasing tool life as much as 300% cuts costs amazingly according to tests run on actual shop operations. Pumps range in capacities from 150 to 1500 gph with tanks from 3½ to 15 gallons.

The manufacturer also indicates that special Spiegel-Spray units can be made to order quickly—with special sizes or shapes of tanks, larger or smaller pumps or units engineered correctly for specific uses.

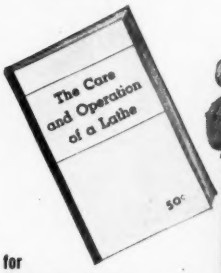
The illustration above, left, is of the Model FS-5 Spiegel Spray unit, which has a 7-gal. tank and rated capacity of 500 GPH.

G. B. Spiegel Corp., 3952 S. Calumet Ave., Chicago, Ill., will send complete details.

SHELDON Back Geared Screw Cutting PRECISION LATHES

1" Collet Capacity Ball or Roller Bearing No. BB U-1136 WQ Sheldon 11" swing, 36" between centers; pre-loaded super-precision spindle ball bearings; spindle hardened and ground all over, inside and out, with 1⅜" hole through center, hand scraped bed, ways (2 V-ways, 2 flat ways), full quick change gear box, worm feed apron with power cross feed, thread chasing dial and 4-speed lever operated underneath pedestal motor drive, and telescopic taper attachment.

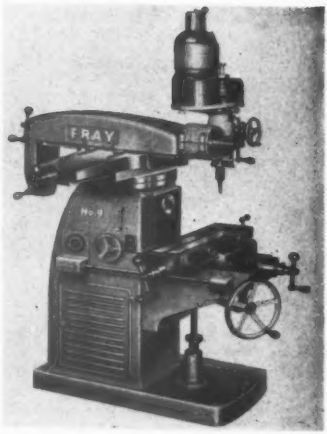
Write for Catalog



for Apprentice Training —a new fully illustrated manual describing "The Care and Operation of a Lathe." List price 50c. Discounts on quantity orders.

SHELDON MACHINE COMPANY, INC.
4236 No. KNOX AVE., CHICAGO, ILLINOIS, U. S. A.

Work Setup Retained For Milling and Boring Operations



THE Fray No. 9 is an all purpose, versatile milling machine that is particularly suited for tool rooms and die shops having a wide variety of operations on a single piece of work. Milling, drilling or boring operations can be done at any angle, longitudinally by traversing the ram on the turret slide, or cross ways by operating the ram in its saddle. Because the No. 9 is both a horizontal and vertical milling machine, practically any operation at any angle or compound angle can be completed without changing the original work setup.

Straddle milling can be handled without the use of spacers, eliminating time-consuming adjustments. The controlled ram movement instantly governs the width of the cut. The ram has a cross travel of 10" and longitudinal travel of 18". For horizontal milling, the turret head can be reversed and the vertical adjustment swung out of the way. The No. 9 then becomes a No. 2 horizontal milling machine, equally suitable for tool room or production work.

This milling machine is equipped with the type E head, which has positive quill lock and six step pulleys. The motor swings completely around the housing and can be locked at any point. The spindle, heavier than in any machine of comparable size, is of SAE 4140 steel, hardened, ground and drilled for draw-in bolts.

Fray Machine & Tool Co., Glendale, Cal., has available new Folder No. 9. Send for your copy.

SPEEDS PRODUCTION! CUTS TIME AND COSTS!

SPEEDY AIR VISE

FAST! POWERFUL!
FOOT CONTROLLED!

$24

Complete with Foot Control Valve, Air Hose and Fittings

HAND FREE OPERATION!

• Foot operation leaves BOTH hands free for fast insertion and removal of work. Vise stays open or closed without constant foot pressure.

Most important vise design in years! A fast-action, hard gripping air vise that speeds production; saves time, labor and costs! Speedy Air Vise operates from air line or individual compressor, exerting a grip of 15 times air pressure! Jaw opening adjustable up to a maximum of 3 inches. Maximum travel of ½ inch assures rapid insertion and removal of work. Employs no piston, but instead a long-life, multiple-type diaphragm . . . eliminating friction loss, air leakage and slippage. Rugged, compact, low priced, it is the ideal vise for speeding up numerous operations.

Write At Once For Circular H-12

W. R. BROWN CORP., 5720 ARMITAGE AVE., CHICAGO, ILL.

Trav-Lift Saves Time, Manpower

AMAZING as it seems, the actual experience reported recently by a metal products plant is that a three-ton overhead traveling crane did a two-day load handling job in one hour with a smaller crew.

The crane, a P & H Trav-Lift (3-motor, double I beam type), is cage operated and equipped with variable speed control. It has a span of 47′ 8″, a lift of 18′ and travels the full length of the plant's receiving and shipping bay.

Cranes of this type are contributing a great deal toward speeding production of war materials. The results of the installation discussed here, it is claimed, are typical in the savings of time and manpower.

With capacities up to 15 tons, Trav-Lifts are suitable for either constant or intermittent crane service for lifting, lowering or moving loads within 15 tons over definite areas in smaller manufacturing plants and in various sections of larger plants.

Harnischfeger Corp., 4531 W. National Ave., Milwaukee, Wis., will send complete details.

YOUR NEW HANDS
Need this HOW-TO-DO-IT Manual

Men who instruct trainees and beginners in metal working tell us this Starrett Book saves much time and many a headache. Presented in simple, straightforward style, completely indexed it is proving invaluable to the student or apprentice and as a helpful "refresher" and reference source for the teacher and the experienced hand as well.

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THE L. S. STARRETT CO., Athol, Massachusetts, U. S. A.
World's Greatest Toolmakers

STARRETT
PRECISION TOOLS • DIAL INDICATORS • GROUND FLAT STOCK
HACKSAWS • METAL CUTTING BANDSAWS • STEEL TAPES

Schauer Awarded Army-Navy E

IN an impressive ceremony, the Schauer Machine Co., Cincinnati, O., was awarded the Army-Navy E for outstanding production achievements. According to A. J. Kohn, general manager, this company is the originator of "Speed Lathes."

Victory Emblems Offered by Gorton

"HI, Buddy—Let's Get to Work for America" is the war slogan being carried into every war production plant by Gorton machine tools. All Gorton vital war machine tools now prominently display this colorful emblem of Victory. Designed to inspire all war workers in the plant, the hi-sign is clearly visible from the first moment the machine arrives. The basic idea is to make Gorton operators in different war plants feel it is as much their duty to step up production as the Gorton workers have felt it their duty to increase the rate of building these high precision machine tools.

The first hi-sign emblems began appearing on Gorton machines the day war was declared. Their enthusiastic reception prompted a decision to label every urgent Gorton machine tool with this patriotic slogan.

The emblem idea at Gorton is a symbol of results accomplished. Workers are inspired to outdo production rates of each previous month, while uniformly maintaining high standards of precision manufacturing developed over a half century of specialized experience in the building of high speed spindle machines and accessories.

Machinery dealers throughout the country handling the Gorton line have been invited to participate.

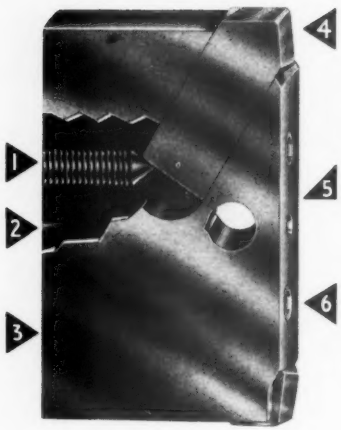
Address George Gorton Machine Co., 1319 Racine St., Racine, Wis., for full information.

DIEBEL Hi-Speed PRESS

Turning out Diebel Stamping Presses with controllable high speeds of 180 to 550 strokes per minute at the Chicago factory. Parts are precision machined and quantity assembled to permit large scale production; lowest selling prices.

Write for Catalog

DI MACHINE CORP.
DIVISION OF DIEBEL DIE & MFG. CO.
3653 N. LINCOLN AVE. CHICAGO



Davis Boring Tools Contain Many Distinctive Features

DAVIS expanding block type boring tools have many exclusive and distinctive features as illustrated at the right. Number 1 shows the cutter support screws, which expand and support the blades. Cutting thrust pressure is taken by these screws. Centers (2) are accurately located in relation to tapered locating hole, permitting grinding of the blocks between centers and eliminating the need of grinding arbors.

The block body (3) is made of specially rolled alloy tool steel. Cutting blades (4) are interchangeable within type and size limitations. Blades are the largest practical size, considering block dimensions, and insure proper heat radiation and maximum cutting life.

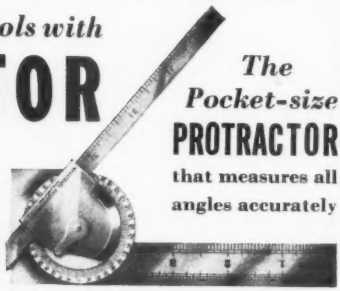
The block is centralized by the tapered locating hole (5) which, when located in position, brings the block firmly up against the back and bottom of the slot. This gives the block a perfect and evenly distributed bearing the full length of the slot. Cutter lock screws (6) clamp the blades firmly and rigidly in position, forcing the blades back against the support screw and firmly up against the top of the blade slot, forming an extremely rigid and substantial tool.

Bulletin No. 301 contains further details. Address Davis Boring Tool Div., Larkin Packer Co., Inc., 6202 Maple Ave., St. Louis, Mo.

Save your Tools with

XACTOR

Insure Greater Efficiency



The Pocket-size

PROTRACTOR

that measures all angles accurately

NOW INDISPENSABLE TO THE CHIEF ENGINEER, RESEARCH ENGINEER, TOOL GRINDER, MACHINIST

!

XACTOR measures directly any surface angle, large or small, such as are ground on cutting tools, without the aid of attachments.

Quickly measures tapers on shallow blind holes or tooth angles on broaches, simply by sliding the Arm to suit your conditions.

Degree-graduations are arranged so the component angle is read directly, as well as required angle.

No clamps, no projecting set-screws, or other clamp-devices. Fits your vest pocket nicely. Ready for instant use.

Write for fully illustrated circular.

INDUSTRIAL ENGINEERING CO., Inc.

141 West Jackson Boulevard, Chicago, Ill.

Can be purchased at Machinists' Supply and hardware dealers in United States and Canada.

Annealing Machine Facilitates Tapering and Crimping Operations

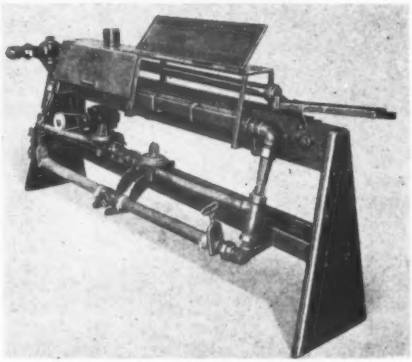
THE use of steel for cartridge cases brought an insistent demand for a machine that would quickly and economically produce a uniform anneal at and near the mouth to facilitate tapering and crimping operations.

Two gas fired, continuous conveyor type machines were designed to achieve the desired results. One (illustrated) accommodates cal. .50 and 20 mm cartridge cases and the other is for all larger sizes.

In the larger annealing machine, a conveyor chain carries rotating work spindles provided with fixtures suited to the size of the cartridge cases being annealed. When desired, the spindles may be provided with different fixtures to permit the handling of cases of various sizes.

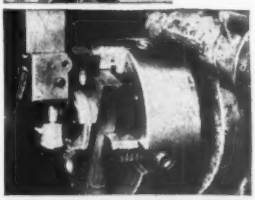
The cases rotate as they pass in front of the flame. Burners are of the blast line type with adjustments to provide compensation for various gases and operating conditions. All controls, including proportional mixers and zero governors, are supplied for a heating section and a holding or soaking section.

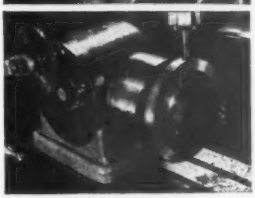
Address Morrison Engineering Corp., 5003 Euclid Ave., Cleveland, O., for Bulletin No. 261.



War Bond Record

Universal Engineering Company, Frankenmuth, Mich., was presented the first bullseye Treasury flag, boasting an amazing 20% pledge and 100% participation.





4 *of the many ways . . .*

SLOTMASTER *can be used to save* **TOOLS & SET-UPS**

Left: Set-up for cutting a spline in an adapter.

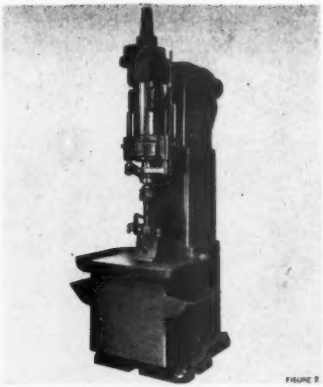
Below: Set-up for cutting an internal gear.

SLOTMASTER can be used on any round or flat-on-round overarm milling machine and will do precision work that normally requires a multi-thousand dollar machine (all of the working parts are of tool steel, heat treated). It takes but little time to change over from one head to the other . . . the stroke of the ram is adjustable from 0 to 4" . . . the speeds range from 50 to 250 s.p.m. The tool holder is of the clapper box type and can be turned in any position . . . SLOTMASTER comes complete with pulleys, motor, mounting bracket, etc. . . . *Send for 4-page catalog—give specifications of the milling machines you wish to equip. Immediate deliveries on high priorities.*

EXPERIMENTAL TOOL & DIE COMPANY

12609 Greiner Detroit, Mich.

Below: Conventional set-up on a round overarm milling machine — thumbnail shows a set-up for chipping a feed cam.



Tapping Machines Available with Single or Multiple Heads

THOUGH designed as special machines, the construction of Detroit tapping machines lends itself to considerable variations. Thus the machines may be provided with either single or multiple tapping heads and can be used for oil grooving or long lead tapping.

The line is featured by the use of a lead screw to assure accuracy, without requiring the lead screw to drive the tap. This is achieved by driving the tapping spindle at a point between the tap and lead screw itself. Thus inaccuracies due to lead screw "wind-ups" are avoided. Lead screws are hardened and ground all over. They operate in adjustable split bronze nuts of exceptional size for long life.

The light duty machine is provided with a sturdy fabricated base and a 4" steel column on which is mounted the motorized tapping head. The design is such that the complete tapping mechanism may be raised and lowered on the column through a worm and rack-and-pinion mechanism to adjust height to the individual operation.

The heavy duty tapping machine (illustrated) has a maximum stroke of 8", permitting long taper lead tapping and oil groove cutting. Accurate tapping is assured because the floating holder is so designed as to allow taps to float horizontally only —without end play.

Detroit Tap & Tool Co., 8436 Butler St., Detroit, Mich., will send complete details.

WELDON ROBERTS

Brightboy

REG. U.S. PAT. OFF.

"The Soft Rubber Binder Cushions the Abrasive"

Check Your Time Savings—*Compare the Results with Brightboy's* 3-WAY ABRASIVE PERFORMANCE

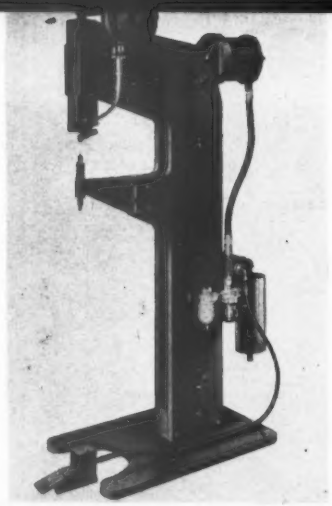
De-burring - Finishing - Polishing

Brightboy's unique abrasive action reduces working time and bridges the gap between the grind and the buff—frequently, doing in one operation, work which formerly required multiple set-ups! THIS MEANS INCREASED PRODUCTION!

Available in wheels, and in blocks, rods and special shapes with innumerable applications for machine, manual and drill press work. Information and prices from your dealer or

BRIGHTBOY INDUSTRIAL DIVISION
WELDON ROBERTS RUBBER CO.
Newark, N. J. U.S.A.

Rivitor Speeds Flush Riveting In Aircraft Production



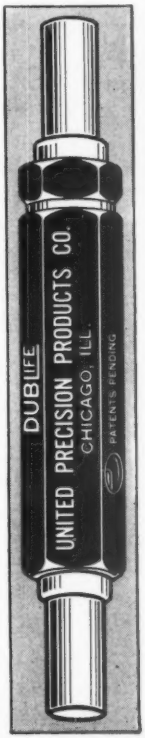
THE new Rivitor, designed to afford increased speed and efficiency of flush riveting in aircraft production, is air powered with automatic feed and setting mechanism. Pressure for riveting is furnished by an air cylinder. The air pressure from the cylinder is applied through a toggle mechanism. This type of construction is made possible by designing the machine to handle exclusively aircraft requirements for aluminum alloy riveting, with capacity for rivets ¼" in diameter and ¾" long.

By using a different type of rivet set and rivet jaw construction this machine can also be adapted to handle countersunk head, round head, full and semi-brazier head rivets.

Upper and lower toolings are accurately aligned and vertical adjustment of the lower tooling can be accomplished without disturbing this alignment. Common variations in the thickness of the materials being riveted are taken care of automatically; major variations are made through manual adjustments. The horn section holding the lower tooling may be removed and replaced with the horn section from any other RP or RS interchangeable horn type Rivitor. Measurements are accurately held to make this possible.

Tomkins-Johnson Co., 630 N. Mechanic St., Jackson, Mich., will supply further details and circular.

"Brazing of High Speed Steel," by S. B. Lement and W. B. Kennedy, will be found on page 64.



ORIGINATORS
and exclusive manufacturers of
DUBLIFE GAGES
and UPPCO FINISH

DUBLIFE

Reversible PLUG GAGE

Tells DEPENDABLY Long after ordinary Gages are worn out!

TWICE THE SERVICE!

and more, is insured by DUBLIFE'S reversible Plugs—both "Go" and "No Go" in same hexagonal handle. Either plug easily turned end for end when worn. Securely locked by bronze collet.

Send for Catalog showing DUBLIFE and other gages of A. G. Design. Write...

UNITED PRECISION PRODUCTS CO.

3516 W. Belmont Ave. Chicago, Ill.

Suprex Gages In War Production

SYMBOLIC of American determination to swamp the Axis powers with a burst of materiel and men is the Suprex Gage Co., only a little over a year old, but which is today one of the country's largest and best equipped precision gage companies as a result of a just completed $750,000 expansion program.

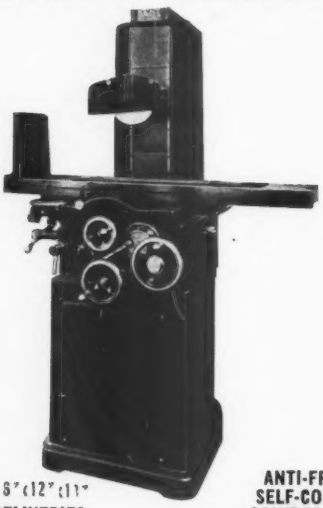
One feature of the new Suprex plant is the large temperature control room with a constant 68 to 70 degree temperature. All equipment is insulated against noise and machinery vibration.

In announcing the new Suprex plant, N. A. Woodworth, president of the company, commented on the importance of the gage industry in the war effort. "There could be no interchangeability of parts for guns and mechanized equipment if the American gage industry was not what it is today. The importance of standard precision gages was realized during World War I when it was found that many repair parts could not be used on equipment damaged on the battlefield.

"So great was the need for uniformity and standardization of measurements that at the conclusion of the war a group of manufacturers convened with the government to establish a definite standard. Today, parts for guns, airplanes, tanks and other battle equipment are checked with standard precision gages so that in Australia, Europe or the Aleutians they are interchangeable.

(Cont'd on Page 147)

ATLANTIC
No. 2 Automatic Precision
SURFACE GRINDER



CAPACITY 6"x12"x11"
PROMPT DELIVERIES

ANTI-FRICTION
SELF-CONTAINED
GRINDER SPINDLE

ATLANTIC MACHINERY CORP.
149 Broadway New York, N. Y.

(Continued from Page 146)

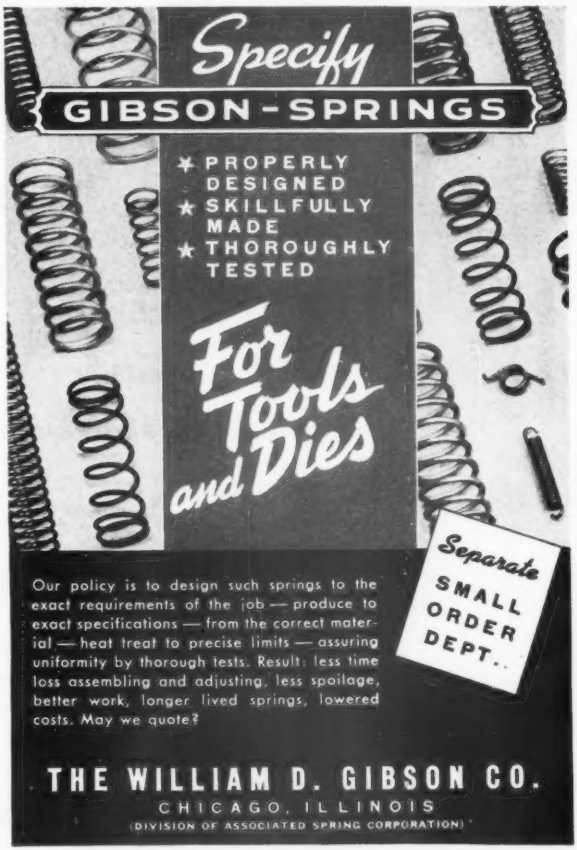
"Today's gages also make it possible to easily and quickly train inexperienced men and women, in the inspection of vital parts for mechanized equipment. Even as late as ten years ago, crude instruments, leaving much to the calculation of the inspectors, were used, but today precision gages are at constant accuracy and durability."

Breaking into an industry with 5000 manufacturers, the company is now said to be one of the leading manufacturers in respect to war production of various types of thread and plug gages.

New production ideas and new equipment are helping American manufacturers to overtake—and pass—the Axis in war production. A new adaptation of the metal saw is shown at the left above where a Suprex employee is splitting thread ring gages before heat treating and while in a rough machine stage. Illustrated above is one of the Suprex grinders, capable of grinding cylindrical plug gages down to .00005 tolerance. This tolerance, which is 1/40 the size of a human hair, antidates the old axiom of tool makers to "grind it down to the size of a hair."

Mr. Woodworth predicted that, by early winter, certain types of gages will be sufficiently stocked to give 48-hour emergency delivery service to war plants. Usually several weeks is required to fill precision gage orders.

For details on Suprex gages address Suprex Gage Co., Dept. S-11, Ferndale, Mich.


Specify
GIBSON-SPRINGS
★ PROPERLY DESIGNED
★ SKILLFULLY MADE
★ THOROUGHLY TESTED
For Tools and Dies
Separate SMALL ORDER DEPT.
Our policy is to design such springs to the exact requirements of the job — produce to exact specifications — from the correct material — heat treat to precise limits — assuring uniformity by thorough tests. Result: less time loss assembling and adjusting, less spoilage, better work, longer lived springs, lowered costs. May we quote?
THE WILLIAM D. GIBSON CO.
CHICAGO, ILLINOIS
(DIVISION OF ASSOCIATED SPRING CORPORATION)

Complete Tool Shop With Management Available

THE possibility of acquiring a plant completely equipped for precision tool and parts manufacture is infrequent under present conditions.

This publication, therefore, considers it a service to Industry and an aid to war production to pass on such an offer.

The plant belongs to a highly successful organization. It is in profitable operation, on tooling for outstanding war products manufacturers.

Machine tools, small tools, shop equipment and accessories are being used every day for making tools and parts to "ten-thousandths" tolerances. Shop personnel consists of approximately 100 long-experienced operators.

Those interested may have additional details by writing The TOOL & DIE Journal, 2460 Fairmount Blvd., Cleveland, O.

New Small Miller

DIAMOND Tool Co. now offers a new milling machine of smaller size which is available in both tool room and production models.

Although considerably smaller in size than other makes and priced correspondingly lower, the number of sales and repeat orders would indicate that Diamond Milling Machines provide the rigidity, precision accuracy and capacity of larger machines.

Careful engineering and practical design are indicated by a precision high speed needle overarm arbor-support bearing; vertical collapsible pulley arrangement, with safety device and motor lock for speed changes; and a one-shot, spider-web lubricating arrangement for the table, saddle and knee.

The production model is equipped with rack and pinion to speed up output. Both the previous Model 24 and the new, smaller Model 20 have interchangeable accessories. Distribution arrangements have not yet been completed and correspondence is invited from dealers who may be operating in open territories.

A detailed bulletin is available from the manufacturers, Diamond Tool Co., Dept. M-12, 3429 East Olympic Blvd., Los Angeles, Cal.

To make drilling or riveting easier

Use KNU-VISE Pliers

To hold parts together for operations such as drilling, or riveting, Knu-Vise Pliers have proved exceptionally efficient because there is no time wasted in fastening or releasing them. One flip of the lever applies the required pressure and another flip releases the work just as quickly. Holding of work is simplified and production is stepped up. Let us show you efficient methods of holding parts for speedy production.

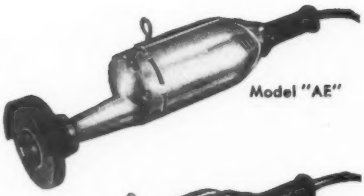
Send for new catalog

KNU-VISE INCORPORATED

1332 Plum St., Detroit, Michigan
4328 San Fernando Rd., Glendale, Calif.

Skilsaw Adds Two New Portable Grinders To Line

TWO new portable grinders have just been added to the extensive line of electric tools manufactured by Skilsaw, Inc. Both are purposely introduced right at the peak of America's greatest production drive because they are especially engineered to meet today's high speed requirements on all grinding, wire brushing, polishing and buffing operations.



Write Skilsaw, Inc., 5061 Elston Ave., Chicago, Ill., for further details.

These portable grinders contain every feature of advanced design and sturdy construction essential to maximum performance and adaptability to a wide variety of applications. Ball bearings mounted in steel inserts on armature and extreme ends of wheel spindle absorb thrust, eliminate vibration and insure cool operation. Commutator and switch are fully enclosed for protection against dust and straight-line ventilation blows dirt away from the operator. Finest steel gears, heat treated for long life and spline-mounted on shafts, are both strong and quiet. Powerful universal motor assures full efficiency under load. Rubber sleeve handle provides a firm, operations in war plants of every type.

Skilsaw Model "AD" portable grinder is 22" long, weighs 15 lbs. and operates at no-load speed of 4500 rpm, driving a grinding wheel 4" x ¾" x ½". Model "AE" portable grinder has a grinding wheel 5" x ¾" x ½", operates at 4200 rpm, weighs 18 lbs. and is 22⅝" long. Both models assure top production on all metal grinding and metal cleaning operations.

TWO MACHINES IN ONE!

For Die-Filing Use Top Table in Position Shown.

For Punch or Blind-Hole Filing Tilt Top Table Back, Use Lower Table.

No more hand filing of intricate jobs or inaccessible parts! With this universal machine you can take care of all filing and lapping jobs as they come along. Stroke fully adjustable from 0 to 1½". Two Speeds. Fully enclosed motor. Ball Bearings throughout. No dripping of oil. No waste of unused file sections.

Write for Descriptive Circular.

MARBURG BROTHERS, INC.
Exclusive Distributors
90 West Street — New York, N. Y.

Valuable Booklet

Forgings For All Industries
Rough Turned or Finished Complete

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Composite Die Sections — Extrusion Tools
Crankshaft Forgings — Gear Forgings
Die Casting Dies

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Rings, Discs, Blocks, Shafts, Hubs, Bars, and Special Shapes. Tool Steel of all Makes
S.A.E. Specifications
STAINLESS & COPPER FORGINGS
May We Serve You?

AJAX STEEL AND FORGE Co.
205 ADAIR STREET — DETROIT, MICHIGAN

Universal Vise

Universal Angle Plate

The **WESSON**
UNIVERSAL VISE

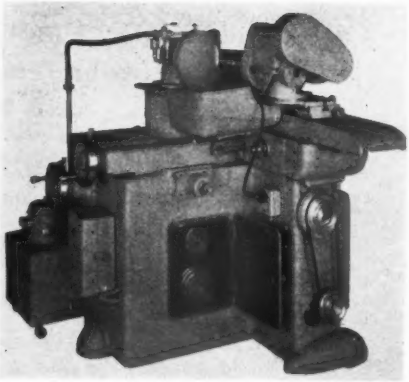
The Quick, Easy Way to Set-Up Compound Angles

Cuts set-up time; insures greater accuracy. Accurately graduated in all planes. Sturdy cradle design and steel construction give greater rigidity; permit faster stock removal. Two sizes, priced for every shop. Can be furnished with slotted surface plate for use as universal angle plate. AVAILABLE FOR IMMEDIATE DELIVERY. SEND FOR FREE FOLDER.

WESSON CO., **Ferndale, Mich.**

Please send me illustrated Folder covering the Wesson Universal Vise.

Name .....
Firm .....
Address .....
City ..... State .....



Covel Grinder Fast, Accurate, Flexible

NO matter what the job, the Covel No. 22 Cutter and Tool Grinder can be set up in minimum time and with maximum accuracy. Working units are controlled by dials which move with a feather touch, but when set and locked remain rigidly in place until the job is complete.

A large diameter grinding spindle, mounted on spring loaded precision ball bearings, keeps a constant load on bearing regardless of temperature and provides automatic take-up for wear. As the bearings are mounted in quills, the entire unit can be removed from the housing. Labyrinth seals are provided to prevent entry of dust. Each bearing is lubricated by a wick feed glass oiler.

The spindle is provided with a lock to make it easy for the operator to change grinding wheels. The left hand end is tapered to receive the grinding wheel collets, while the right hand end is straight to accommodate small diameter cup grinding wheels.

The motor drives a countershaft through a V-belt, providing three speeds. This countershaft drives the spindle through another V-belt extending through the center of the column. Each belt is adjustable independently. The entire drive assembly turns, raises and lowers as a unit with the head so that the belt tension is always the same. Head swings 360° and has a large graduated dial for accurate setting.

Covel Mfg. Co., Benton Harbor, Mich., has Bulletin TD-112 available.

Meyers "Dia-brasive" Radius-Angle Former

Upright shaft for adjusting diamond holder to various vertical positions.
Automatic diamond locating device.
Adjustable swinging diamond tool fashioned to outline full concave radius of 180°.
Dual-purpose tool holder supporting a vertical and horizontal nib.
Locking screw to hold swivel platen in desired position.
Screw driven elongated slide adjustable to .001" by attached graduated dial operated by spring clutch to desired reading.
Vernier graduated swivel platen insulated for rotation on magnetic chuck forms convex and concave radii outlines.
Crank for smooth manipulation.
Ball bearing graduated base platen slotted and centered for flexibility of installation is simply and quickly mounted.

FOR WAR-TIME PRODUCTION IN PRECISION GRINDING . . . .

● This precision tool, fashioned for simple and speedy installation on various machines, makes possible speedy, precise radial and angular forming of grinding wheels—from any angle. Adjustable to precision, engineered for sturdy, dependable service. Write or wire for literature and prices.

W. F. Meyers Co., Inc., Dept. T, Bedford, Ind.

Aggressive Mfrs. Rep. wanted in East, West and South

Carborundum MX Wheels Resilient, Flexible

THE new MX Wheels take their place among many Carborundum Brand products designed to increase production and to produce better finishes in the metal working field. They are made of thin discs of cotton fibres impregnated or mixed with either the uniformly graded grains or Aloxite Brand aluminum oxide or Carborundum Brand Silicon Carbide. The thin discs are bonded together or built up in the form of wheels of various diameters and thicknesses.

The MX wheels are so fabricated as to give variable degrees of resiliency and flexibility. The result is a clean, free cutting wheel, giving a light stock removing and a high polishing action with the least amount of pressure.

The wheels are to be used dry since no coolant is required at the temperature developed —on any type of flexible shaft machine or electric hand grinder. They should be mounted between relieved flanges and should be dressed with an abrasive stick as required. Recommended operating speeds range from 6000 to 8000 sfm.

There is a decidedly wide application for these new wheels in the finishing and polishing of the out-of-the-way places on airplane engine parts and similar work. They may be used for breaking down burrs or sharp edges on gear teeth; finishing and polishing spline

(Cont'd on Page 153)

MAKE-ALL RADIUS DRESSER

You will prefer the MAKE-ALL for simplified *Concave and Convex Radius Dressing* because it is so easy to operate. Feature of the Make-All is simplicity of design that results in an unusual degree of accuracy for a radius dresser requiring no difficult calculations, depth gauges, micrometer or vernier setting. Send priority rating with your order for prompt delivery.

ATTACHMENT FOR FULL SEMI-CIRCULAR RADII

A special attachment accurately made, which with the use of Rattail Diamond Tools, will make full semi-circular radii as small as 0.035". Available at small additional cost.

$62.50 MAKE-ALL with one 60° GOLCONE Diamond Tool.

$72.50 MAKE-ALL with 60° GOLCONE, semi-circular radii attachment and Rattail Tool for 0.070" or larger radius.

Distributed by

Golconda Diamond Products Corp.

3856-58 NORTH ASHLAND AVENUE • CHICAGO, ILL.

(Continued from Page 152)

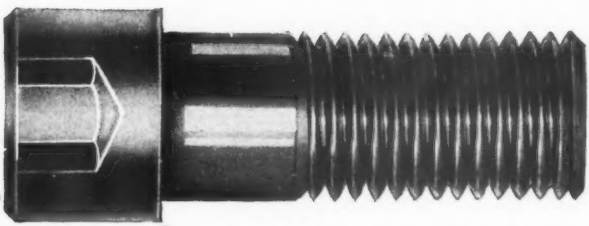
grooves; polishing internal diameters; for smoothing sharp edges of holes and for all types of undercuts.

The MX wheels are made in six grades —Numbers 1 through 6. The harder grades, Numbers 1, 2 and 3, are recommended on work having a more severe dressing action on the wheel—for removing sharp burrs, breaking down edges of gears. The Numbers 4, 5 and 6 grades are recommended for the polishing of small plane surfaces or areas. Diameters range from 1" to 12" and thicknesses from $\frac{1}{16}$" to 3".

The Carborundum Co., Dept. W, Niagara Falls, N. Y., will send complete information at your request.

Berkeley Opens New Plant

BERKELEY Equipment Co., Corry, Pa., announces the opening of a new factory at Danville, Ill. L. J. Berkeley, president, states that the demand for their machine tool drives, automatic arc welding equipment and custom built machinery has grown so rapidly in recent years that the capacity of their two plants is no longer adequate. Berkeley products, which found ready acceptance in peacetime industry, are now widely employed in the war program.



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- Sturdy Cold-Formed Head with Unimpared Continuity of Fibres
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ELLWOOD CITY, PA.: JOHN S. FISHER, 9 FIFTH AVE.
PITTSBURGH: L. A. REISMAN, 2035 FIFTH AVE.

British Plastics In Battledress

(Continued from Page 114)

ers and grinders (with attachments), but possess no duplicating machines of the Keller or Gorton type.

I have said that there are no fundamental differences in the technique of mold design and construction in the two countries. How far this is true may be better judged from the example which follows. This is a motor mounting for a domestic vacuum cleaner and I choose it because it has many interesting features. It was made to the specifications of a firm of American origin, manufacturing in Britain. Before a mold could be designed it was necessary to obtain complete detailed information from the molders as to the type of press available, the type of power to be used, methods of heating and class of labor to be employed. Having obtained this information, the designer was confronted with several methods of construction, but after careful consideration in collaboration with a practical engineer the design shown in Fig. 1 was produced.

Insuring Complete Accuracy

The design is self-explanatory, but a few extra notes may be helpful. This tool was designed for a side ram press and the method of withdrawing the main side core from the side of the mold is illustrated in Fig. 1. The cam tracks shown in Fig. 2 operate simultaneously upon opening the side ram and withdraw the auxiliary side core pins sufficiently for the molding to be ejected.

As will be gathered from the detail drawings shown, all dimensions were given to the mold makers, which insured complete accuracy throughout the mold. This was considered essential in manufacturing a mold of this type due to the various mating parts that had to be accurately assembled. At the same time, it saved a considerable amount of labor hours. A single impression mold was designed for this component to give a high rate of production and to save time in molding the side holes. A multiple impression mold could not successfully incorporate these two features.

The choice of steel was largely influenced by the fact that the mold has several fragile projections. Should these have failed during mold operation,

(Cont'd on Page 155)

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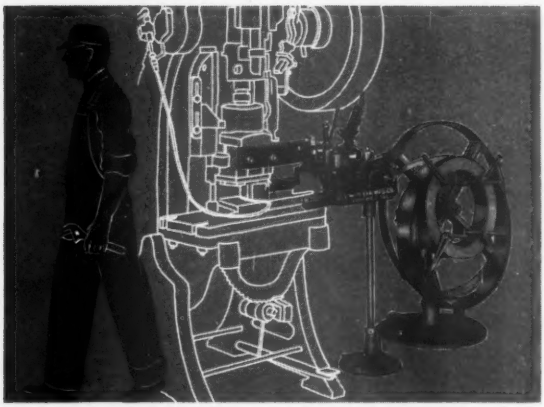
WITTEK *Automatic*

ROLL FEEDS AND REEL STANDS



The major problem confronting industry today is increased war production. Manufacturers of metal stampings must recognize automatic feeding of coiled strip stock to punch presses as vital to the solution of their problem.

Wittek Automatic Roll Feeds and Reel Stands are designed and built by engineers with years of experience to guide them. With Wittek you can conserve man-hours and maintain new high production schedules.

✱ *Write for Descriptive Catalog*

WITTEK MANUFACTURING CO., 4305 W. 24th Pl., Chicago, Ill.

(Continued from Page 154)

serious consequences would have arisen. It was, therefore, decided to use a nickel-chrome air hardening steel, and while this did not produce a dead hard surface, it eliminated a considerable amount of risk involved in using an oil or water hardening type of steel. The materials forming the main parts of the mold were ordered as forged blanks, which reduce as much as possible the internal strains and stresses in the material. It was advisable to obtain as large a blank as possible for carrying the split halves to counteract any distortion likely to take place during the molding, there being an obvious trend to open out.

Mild Steel Forgings

A thick top bolster was used to carry the main top impression in an endeavor to overcome the tendency of the plunger to slide forward due to the unequal shape of the molding. The bolster, top plates and clamping plates were made from mild steel forgings, and the pins molding all holes (with the exception of the sliding pins producing the side holes) were made in a heat treated material. This was done because of the peculiar construction of the mold. The method of inserting the various small core pins was adopted because it was impracticable to incorporate knockout holes. The risk of the pins becoming loose during operation had to be avoided. These pins were made in a heat treated material so that if necessary they could be drilled out and replaced. The guide pins and bushings were made from case hardened steel.

The main bottom force of the mold shown in Fig. 3 was made in two halves with a parting line running around the center of the component, but offset on one edge of the center rib. This was essential, since otherwise the projection forming the center rib would have been too fragile to stand up to the pressure required. The split halves were made a force fit into the bolster and dowelled as shown. This method required considerable accuracy for the correct alignment of the dowels and split halves.

Plug A Loose Part

The top and side impressions were built up to facilitate the manufacture

(Continued on Page 156)

FLATNESS and SMOOTHNESS
of Production Parts
The Ultra-Lap machine will finish your parts to a flatness of one light band or less . . . to a smoothness as low as one micro-inch R.M.S., any metal or material. Much faster, more uniform than hand method. Machine designed for you or we shall be pleased to lap your parts on a job basis. Ultra-Lap machines and service used by aircraft and many other war-time industries.
Ultra-Lap MACHINE COMPANY
245 McDOUGALL AVE. - DETROIT, MICH.

(Continued from Page 155)

of these parts. Due to the high degree of accuracy required on some dimensions, metal was left to be removed after the correct sizes were found by trial. It was impossible to give a figure, with any degree of confidence, that would insure the size being to the limits required after contraction upon cooling.

Hardened strips were incorporated on the top and bottom bolsters which were used as pressure pads during the final pressing. This method, to a certain extent, did leave flash, but it safeguarded the shutting down faces on the actual mold impression. The various studs, bolts, etc., were made in high tensile steel. The mold was electrically heated and a special heat resisting asbestos was employed for insulating heat from the main body of the press.

Equipment Used

The manufacture of a mold of this description required the use of the usual tool room equipment, including die sinking, Pantograph milling, engraving and boring machines. It was essential that the finish obtained was accurate and good to eliminate as much as possible the amount of hand work necessary in obtaining a high degree of polish.

Datum holes were given on all intricate parts. From these all subsequent operations were carried out. This insured complete accuracy and alignment in all operations. Profile templates, as well as various special purpose cutters, were made for all irregular forms. As it was not permissible for any flash lines or ejector marks to appear on the exterior of this molding, it was necessary to machine from the solid the complete form with the projection shown in section "AA" (detail of bottom impression, Fig. 3).

It was considered impracticable to mold some of the small holes, which were deep in relation to their diameter, as the flow of molding material under pressure would have bent them. Dimple pins were, therefore, fitted to spot the holes for drilling after molding. In an endeavor to maintain accuracy on hole centers and other dimensions, cooling blocks were successfully used. Mechanical ejection of this molding was unnecessary; the method adopted was to cold blast the head room of the bottom impression, which enabled the operator to withdraw the molding satisfactorily by hand.

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GREATER IN RIGIDITY Supreme IN ACCURACY

Improvements incorporated in this machine greatly extend its utility. Bigger jobs can be handled, more clearance has been provided for fixtures and table has been re-designed for greater rigidity.

The Improved Linlev is unsurpassed for small jig, die and fixture work of all kinds as well as for pattern and layout work. Its simplicity, speed and accuracy contribute to its utility and economy. Availability of correct speeds reduces tool breakage to a minimum.

Features include ball bearings throughout and a micrometer screw feed grill and depth stop gauge which makes it possible to machine to pre-determined depths accurately without first resorting to pencil figuring.

CONDENSED SPECIFICATIONS
Table Size—7 in. x 17½ in.
Tee Slots—3
Table travel (long.)—10 in.
Table travel (cross)—6 in.
Table top to spindle (Max.)—11½ in.
Spindle speeds (8) 275 — 4250 R.P.M.

Write at once for a copy of Bulletin M giving complete details.

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Unique Dual Clamping Setup Featured

FEATURING a unique dual clamping arrangement that separately holds the boring bar in the holder and the holder to the lathe, the Clayton Mfg. Co. announces production of large type bars and holders for lathe swings from 9" to 36". The special design of the holder, allowing its removal from the lathe without disturbing alignment of the boring bar, saves a considerable amount of time and increases the accuracy of duplicate operations.

The permanent calibrations on the bars, which eliminate the need for file or chalk marks, are another time saving feature. Quarter-inch calibrations are engraved into each end of the bar for some distance back from the tool bit hole, thereby eliminating the need for file marks.

With the Clayton holder, which has a separate clamp for attaching the holder to the lathe compound, it is possible to maintain the same tool height and bar stick-out in such operations as boring, turning and cutting of bushings, since the bar need not be removed from the holder when the holder is removed from the lathe.

Send for descriptive folder. Address Clayton Mfg. Co., Dept. J., Alhambra, Cal.

The enlarged Buy-With-Confidence section, pages 174-186, will prove helpful in solving the "who-makes-it" problem.

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PUBLICATION PREVIEWS

Sales and Technical Literature

Send Request on Company Letterhead

KELLER POWER HACK SAW—A four-page folder pictures and gives complete specifications for the Keller Hack Saw. Prices are included. A copy of this folder is available from Sales Service & Mfg. Co., 473 N. Cleveland Ave., St. Paul, Minn.

NEBEL LATHES—An endeavor has been made to illustrate and describe the complete line of Nebel lathes and attachments in an 84-page catalog. Simplicity in design, rigid construction, accuracy and ease of operation are the features that have been given careful consideration. The reader is taken through a tour of the offices, engineering department and plant via the catalog pages. Special setups are pictured. Address Nebel Machine Tool Co., Dept. D12, Cincinnati, O., for your copy. Please use company letterhead when writing.

ROTAREX GRINDER—High working accuracy and variable speed drive ranging from 3000 to 6000 rpm fit the Rotarex, it is claimed, for every grinding job. All attachments for the Rotarex are complete units in themselves and can be quickly and easily interchanged, giving the machine the greatest possible operating scope. Douglas Machinery Co., Inc., 150 Broadway, New York, N. Y., will send descriptive bulletin and details on request.

ZAGAR COLLET CHUCKING FIXTURE—is a universal device for indexing or holding work on machine tools. Two types are available: one, for holding and indexing, and another for holding only. Each type is furnished in 1" and 2" sizes, with capacities up to and including 1" and 2" diameter round shanks respectively. Bulletin C12, now available from Zagar Tool Co., Inc., 23880 Lakeland Blvd., Cleveland, O., contains actual shop photographs, diagrams and specifications. Send for your copy.

HYDRAULIC ARBOR PRESSES—A profusely illustrated catalog, issued by K. R. Wilson Co., 10 Lock St., Buffalo, N. Y., describes the important design and construction features of Wilson presses. Specifications are included. A copy is available on request.

MAGNUS CLEANERS—A 52-page booklet, "Metal Cleaning in War Time", outlines in detail the metal cleaning problems of production for war and indicates the Magnus products best suited for each problem. In addition to munitions production cleaning, this handbook covers outstanding cleaning operations required in the production of ordnance, small arms, materiel and transport equipment. Diagrams, shop application photographs and tables make this booklet a "must" for tool rooms and die shops. Address Magnus Chemical Co., Inc., Dept. C, Garwood, N. J., for your copy.

N.A.S. STANDARDS—Having pioneered in the manufacture of internal wrenching bolts for the aircraft industry, Holo-Krome Screw Corp., Hartford, Conn., is pleased to have the opportunity of making available this valuable and important data to all aircraft designers and engineers. The 16-page catalog contains tables, set in clear and readable type, with corresponding diagrams at the top of each table. Material and finish specifications are also given.

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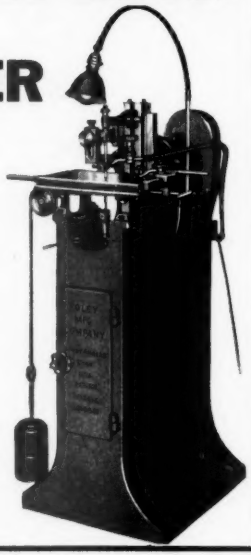

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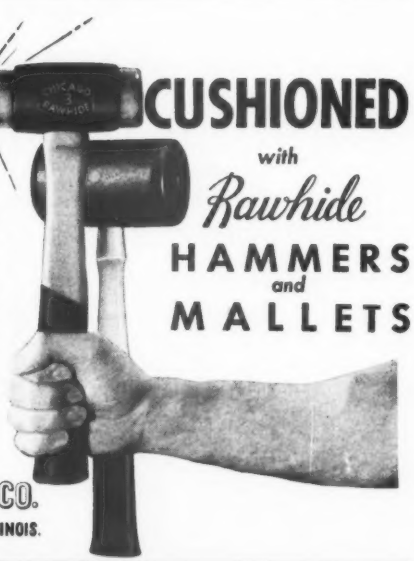

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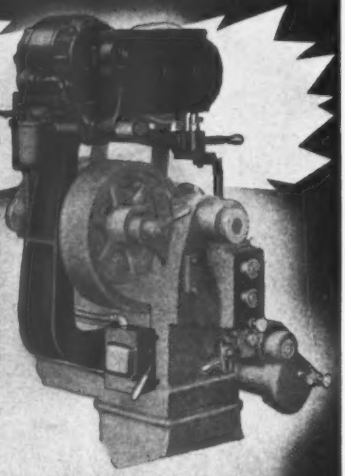

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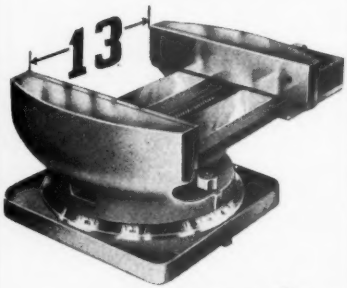

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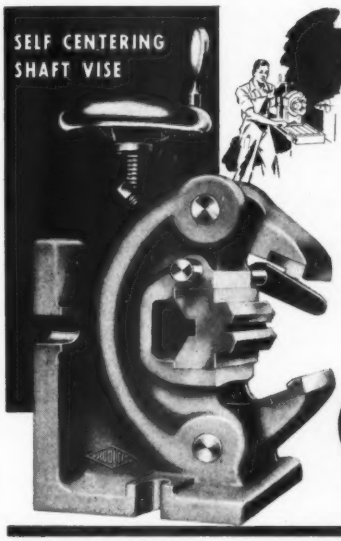

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Gairing TOOLS

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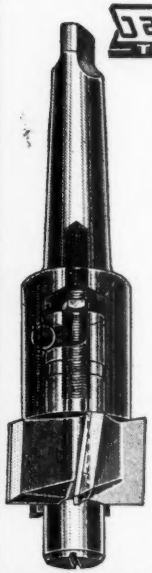

These handy Gairing kits speed production on all counterboring and spotfacing operations. Available in seven sets containing a neatly boxed assortment of *interchangeable* counterbores, pilots and holders. *Write today for prices and literature.*

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For a quarter century specialists in fine cutting tools.

This set consists of one Type B-2 holder, 9 cutters ranging from 3/8" to 1 1/8", 9 pilots from 1/4" to 7/8" and 2 countersinks 7/8" dia.—70° and 82°.

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We have designed and built special gages of every type and description for a number of leading production manufacturers. Our facilities for designing and making precision gages and jig and fixture work are among the best.

Continuous special training of skilled craftsmen assures the finest precision work to meet the most rigid specifications of leading users of precision gages, gaging fixtures and small stamping dies.

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Where you need the greatest possible strength, Mac-it Hex Head Cap Screws will meet your requirements.
They're accurately milled, with die-cut threads, and heat-treated for approximately 145,000 pounds per square inch.
For Hexagon Head Cap Screws That HOLD . . .
SPECIFY MAC-ITS!
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There is a Bokum Boring Tool available to meet *any* size requirement up to the capacity of the machine on which the tool will be used, from diameters of 3/32" to infinite diameters.

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Bokum Tools are made for three distinct purposes: (1) Style A, for general boring, (2) Style B, for facing and bottoming, and (3) Style C, for internal threading.

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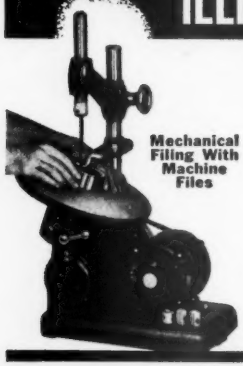

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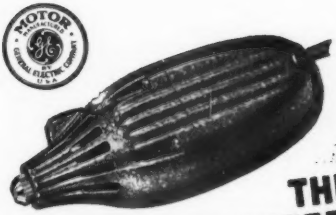

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"This meter of exclusively American manufacture requires 10 accurately shaped vibrating reeds which are rapidly and economically produced by women operators with DI-ACRO EQUIPMENT.
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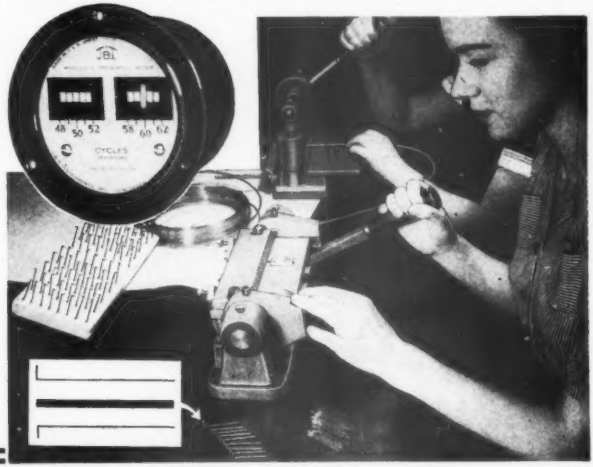

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CERROMATRIX (Melting Temp. 250° F.) For securing punch and die parts, anchoring machine parts without expensive drive fits, short run forming dies and other metal-working applications.

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Knurled SOCKET HEAD CAP SCREWS

Try "Unbrako" Socket Head Cap Screws and **find out** how the **knurled heads** speed the job—and reduce lost motion.

The **knurling** gives a firm grip, prevents slipping, so that the fingers—handiest of wrenches—can be used to best advantage. **Knurled** heads can be gripped by pliers for making minor adjustments. "Unbrako" Screws have unbelievable strength—are precision made. Deliveries are better than usual. Write for Catalog—today.

Sizes: No. 4 to 1½" diameter.

Knurling of Socket Screws originated with "Unbrako" years ago.

STANDARD PRESSED STEEL CO.

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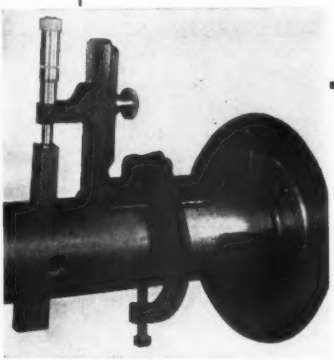
TOOL SETTING GAUGE SAVES TIME — LABOR



Today time is too vital—labor too essential —to risk the waste of both because of inaccuracies in setting boring tools. Here the Bartelt Tool Setting Gauge enables *inexperienced* men and women to accurately and speedily set cutting tools in boring bars.

Production is speeded, costly errors are eliminated, and the facilities of the inexperienced are utilized advantageously.

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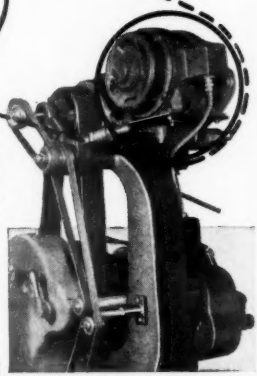

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On small parts up to 7" in diameter, 11" in length.

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Table Feeds—3/8", 1 1/16", 1 1/8", 1 1/2", 2 1/2", 3 3/8" per minute.
Work Spindle Speeds—73-104-144-213-294 revolutions per minute.
Wheel Spindle Speed—2750 rpm. Spring Action Tail Stock.
Capacity 1/8" to 7" diameter, 3/4" to 11" length.
Wheel—10" x 3/4" x 2". Tank Capacity—3 1/2 gallons.
Spindle Motor—1/4 hp, AC, 60 Cycle, 110/220 Volt. Wheel Head Motor—1 hp, AC, 60 Cycle, 110/220 Volt. Regular equipment includes emery wheel, diamond wheel dresser, belts and wrenches.

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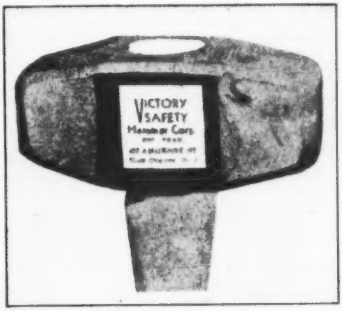

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Perfect Balance

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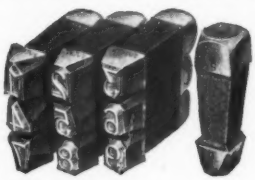

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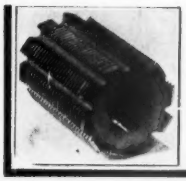

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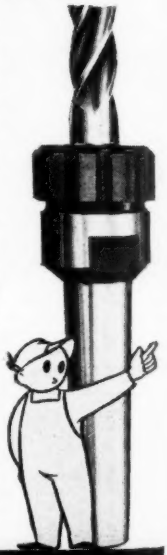
The Universal collet chuck shown here has ground threads, ample room for tool feed out and is ideal for holding end mills, keyway cutters, drills, etc. Write for facts.



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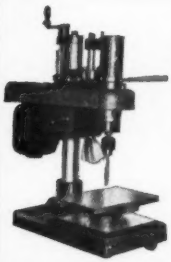

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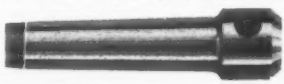

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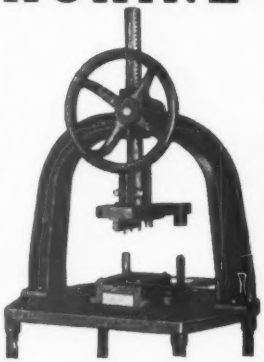

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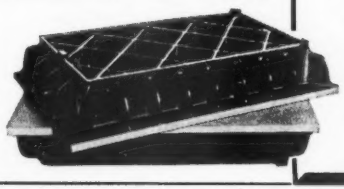

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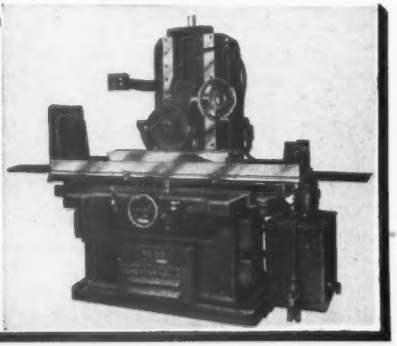

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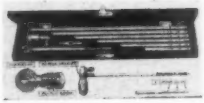

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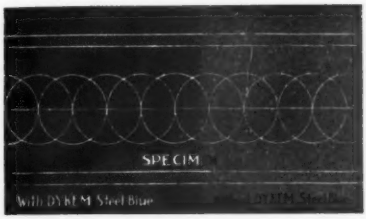

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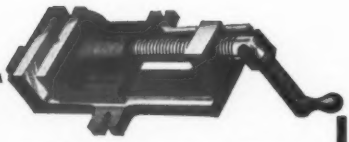

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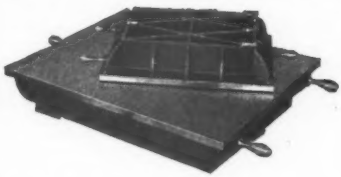

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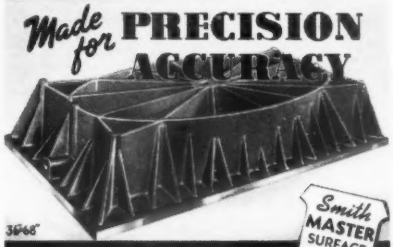

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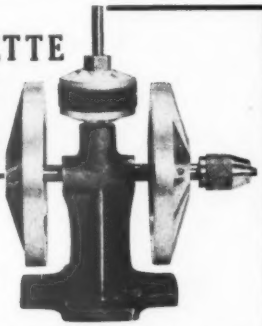

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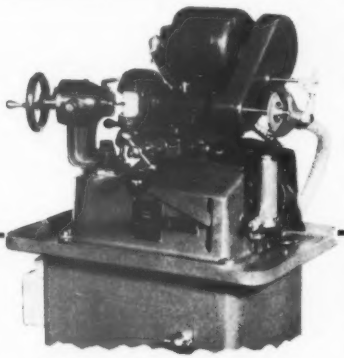

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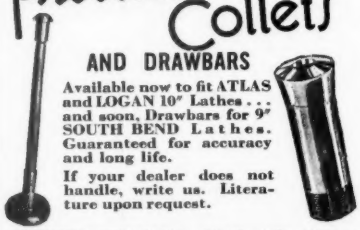

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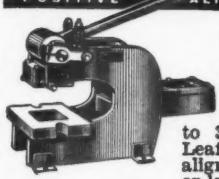

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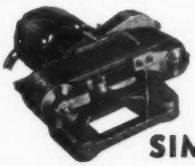

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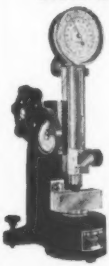

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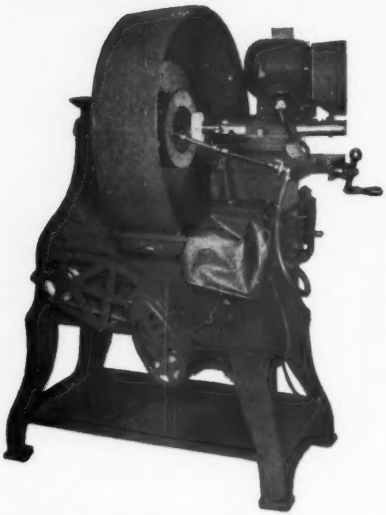

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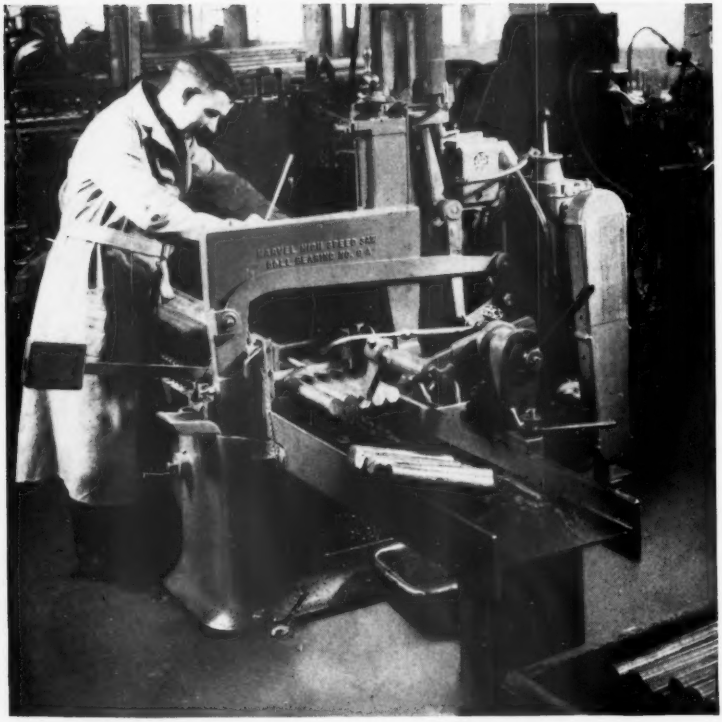

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